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Midwest Vegetable Trial Report for 2016

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Midwest Vegetable Trial Report for 2016

Compiled by
Elizabeth T. Maynard
Brad Bergefurd

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Strawberry

Sweet Corn

Tomato

Watermelon

Winter Melon

Sources of Vegetable Seeds

Seed Code	Seed Company Name and Address
AC	Abbott and Cobb, Inc., PO Box 307, Feasterville, PA 19053-0307; (800) 345-SEED; www.abbottcobb.com
ADV	Advanta/Pacific Seeds, PO Box 337, 268 Anzac Ave., Toowooma, Queensland, Australia 4350; www.pacificseeds.com
AGH	Agrohaitai, PO Box 45, 2764 Hwy 99 (Governor's Road), Lynden, Ontario L0R 1T0, Canada; (519) 647-2280; www.agrohaitai.com
AT	American Takii, Inc., 301 Natividad Road, Salinas, CA 93906; (831) 443-4901; www.takii.com
BC	Baker Creek Heirloom Seed Co., 2278 Baker Creek Road, Mansfield, MO 65704; (417) 924-8917; rareseeds.com
Bas	Basso Seeds, Avenida Monteverde 3390, (B1852WAB) Burzaco, Buenos Aires, Argentina; (54-11) 4299 0880; Fax: (54-11) 4238 3527; www.basso-ar.com
BE	Bejo Seeds, Inc., P.O. Box 859, Oceano, CA 93475; (805) 473-2199; Fax: (805) 473-0897; www.bejoseeds.com
BHN	BHN Seed, PO Box 3267 Immokalee, FL 34143; (239) 352-1100; Fax: (239) 352-1565; www.bhnseed.com
BU	W. Atlee Burpee & Co., 300 Park Ave., Warminster, PA 18974; (800) 888-1447; www.burpee.com
CF	Clifton Seed Co., 2586 NC 403 West, PO Box 206, Faison, NC 28341; (800) 231-9359; www.cliftonseed.com
CO	The Cook’s Garden, PO Box C5030, Warminster, PA 18974-0574; (800) 457-9703; www.cooksgarden.com
CN	Corona Seeds, Inc., 590-F Constitution Ave., Camarillo, CA 93012; (805) 388-2555; Fax: (805) 445-8344; www.coronaseeds.com
CR	Crookham Co., PO Box 520, Caldwell, ID 83606-0520; (208) 459-7451; Fax: (208) 454-2108; www.crookham.com
CP	CropTech Seeds, 1220 Willow Street, Vincennes, IN 47591; (812) 882-0210
DP	DP Seeds, LLC., 8269 E. US Highway 95, Yuma, AZ 85365; (928) 341-8494; dpseeds.com
DVG	Dutch Valley Growers, Inc., 4067 E. 4000 N. Road, Bourbonnais, IL 60914; www.dutchvalleygrowers.com
EV	Evergreen Seeds, Evergreen YH Enterprises, PO Box 17538, Anaheim, CA 92817; www.evergreenseeds.com

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Seed Code	Seed Company Name and Address
EW	East-West Seed International Ltd., No. 50/1 Moo 2, Sainoi-Bang Bua Thong Road, Amphur Sainoi, Nonthaburi 11150, Thailand; +66 (02) 831 7700; www.eastwestseed.com
EX	Express Seed, 51051 US Highway 20, Oberlin, OH 44074; (800) 221-3838; Fax: (440) 774-2728; www.expressseed.com
EZ	Enza Zaden USA, Inc., 7 Harris Place, Salinas, CA 93901; (831) 754-2300; Fax (831) 754-2975; www.enzazaden.com
GU	Gurney's Seed and Nursery Co., PO Box 4178, Greendale, IN 47025-4178; (513) 354-1492; Fax: (513) 354-1493; www.gurneys.com
HARC	Hawaiian Agriculture Research, PO Box 100, Kunia, HI 96759; (808) 621-1350; Fax: (808) 621-1399; harc-hspa.com
HM	HM Clause, Inc. (Fomerly Harris Moran Seed Company), 260 Cousteau Place, Suite 100, Davis, CA 95618; (800) 320-4672; hmclause.com
HR/H	Harris Seeds, 335 Paul Road, PO Box 24966, Rochester, NY 14692-0966; (800) 544-7938; Fax: (877) 892-9197; www.harrisseeds.com
HMS	High Mowing Organic Seeds, 76 Quarry Road, Wolcott, VT 05680; (802) 472-6174; www.highmowingseeds.com
HI	Highmark Seed Company, 5313 Woodrow Lane, Hahira, GA 31632; (229) 561-4545
HL	Hollar & Co., Inc., PO Box 106, Rocky Ford, CO 81067; (719) 254-7411; Fax: (719) 254-3539; www.hollarseeds.com
HO	Holmes Seed Co., 2125-46th St. N.W., Canton, OH 44709; (330) 492-0123; Fax: (877) 492-0167; www.holmesseed.com
HZ	Hazera Seed, Inc., 6601 Lyons Road, Suite H-10, Coconut Creek, FL 33073; (954) 429-9445; Fax: (954) 429-9895; www.hazerainc.com
IFSI	Illinois Foundation Seeds, Inc., 1083 County Road 900 N., Tolono, IL 61880; (217) 485-6260; www.seedgenetics.com
J	Jordan Seeds, Inc., 6400 Upper Afton Road, Woodbury, MN 55125-1446; (651) 738-3422; www.jordanseeds.com
JS	Johnny's Selected Seeds, PO Box 299, Waterville, Maine 04903; (877) 564-6697; Fax: (800) 738-6314; www.johnnyseeds.com
JO	Jones Farms, 7094 Honeysuckle Lane, Bailey, NC 27807; Fax: (252) 235-0155; www.jonesfarmsnc.com
JU	J.W. Jung Seed Company, 335 S. High St., Randolph, WI 53956; (800) 297-3123; www.jungseed.com
KB	K&B Development LLC, 10030 New Avenue, Gilroy, CA 95020 rbarham@garlic.com or laurabarhambrown@gmail.com

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Seed Code	Seed Company Name and Address
KTS	Kitazawa Seed Company, 201 4th Street, #206, Oakland, CA 94607; (510) 595-1188; Fax: (510) 595-1860; www.kitazawaseed.com
KU	Known-You Seed Co., LTD., No.114-6, Zhuliao Road, Dashu District, Kaohsiung 84043, Taiwan; www.knownyou.com
LS	Long & Sweet LLC, PO Box 502, 516 N. 5th St., Lafayette, IN 47902; (765) 420-9606
MKS	Mikado Kyowa Seed Co., Ltd., 15-13 Naneidai-cho, Shibuya-ku, Toyko, Japan; www.mikadokyowa.com
MO	Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167; (314) 694-1000; www.monsanto.com
MCS	Morgan County Seeds, 18761 Kelsay Road, Barnett, MO 65011-3009; (660) 287-2400; Fax: (573) 378-2655; www.morgancountyseeds.com
NDS	New Dimension Seed, PO Box 1294, Scappoose, OR 97056; www.newdimensionseed.com
NH/NU	Nunhems Seed USA, Inc., 1200 Anderson Corner Road, Parma, ID 83660; (800) 733-9505; www.nunhemsusa.com
NC	North Carolina State University, 2016 Fanning Bridge Road, Fletcher, NC 28732
NMSU	New Mexico State University Seed Certification, PO Box 30003, MSC 3LEY, Las Cruces, NM 88003-8003; (575) 646- 4139; Fax: (575) 646-8137
NS	New England Seed Co., 3580 Main St., Hartford, CT 06120; (800) 825-5477; Fax: (877) 229-8487; www.neseed.com
NZ	Hybrid Seed Company New Zealand Ltd., PO Box 8068, The Terrace, Wellington, New Zealand; www.hybridseed.co.nz
OG	Origene Seeds Ltd., PO 699, Rehovot, 76100, Israel; www.origeneseeds.com
OR	Orsetti Seed Co. Inc., 2300 Technology Parkway, Ste. 1, PO Box 2350, Hollister, CA 95024-2350; (831) 636-4822; Fax: (831) 636-4814; orsettiseeds.com
OUT	Outstanding Seed Company, LLC, PO Box 202, Monaca, PA 15061; (877) 248-4567; www.pumpkinvegetableorganicseeds.com
P	Pacific Seed Production Co., 94904 Highway 99 E., PO Box 85, Junction City, OR 97448; (800) 547-8004; www.forbesseed.com
PA/PK	Park Seed Co., 3507 Cokesbury Road, Hodges, SC 29653; (800) 845-3369; www.parkseed.com
PAN	PanAmerican Seed Co., 622 Town Road, West Chicago, Illinois 60185; (630) 231-1400; www.panamseed.com

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Seed Code	Seed Company Name and Address
PC	Plug Connection, 2627 Ramona Drive, Vista, California 92084; (760) 631-0992; Fax: (760) 940-1555; www.plugconnection.com
PG	The Pepper Gal, PO Box 23006, Fort Lauderdale, FL 33307; (954) 537-5540; www.peppergal.com
PT	Pinetree Garden Seeds, PO Box 300, New Gloucester, ME 04260; (207) 926-3400; www.superseeds.com
PL	Pure Line Seeds, Inc., PO Box 106, Lodi, WI 53555; (608) 592-7510; www.purelineseed.com
PG	Potato Garden, 12101 2135 Road, Austin, CO 81410; (877) 313-7783; www.potatogarden.com
PV	Pop Vriend Seeds BV, PO Box 5, 1619 ZG Andijk, The Netherlands; +31 (22) 859-1462; www.popvriendseeds.com
PVO	Peaceful Valley Farm Supply, Inc., PO Box 2209, 125 Clydesdale Court, Grass Valley, CA 95945; (888) 784-1722; www.groworganic.com
R	Reed's Seeds, 3334 N.Y.S. Rt. 215, Cortland, NY 13045-9440
RM	Reimer Seeds, PO Box 206, Saint Leonard, MD 20685-0206; Fax: (866) 716-4748; www.reimerseeds.com
RI/RSP	Rispens Seeds, Inc., 1357 Dutch American Way, PO Box 310, Beecher, IL 60401; (888) 874-0241; www.rispensseeds.com
RU	Rupp Seeds, Inc., 17919 County Road B., Wauseon, OH 43567-9458; (800) 700-1199; www.ruppseeds.com
RZ	Rijk Zwaan USA, Inc., 701 La Guardia Street Suite A, Salinas, CA 93905; (831) 455 3000; Fax: (831) 455 3003; www.rijkzwaanusa.com
SK/SAK	Sakata Seed America, 18095 Serene Drive, Morgan Hill, CA 95037; (408) 778-7758; www.sakatavegetables.com
SC	Scott Seeds, 4876 N. Road H, Vale, OR 97918; (541) 473-3246; www.scottseed.com
SfI	Seeds of Italy, LTD, D2 Phoenix Business Centre, Rosslyn Crescent, Harrow, Middx, HA1 2SP; +02 (08) 427-5020; www.seedsofitaly.com; U.S. Distributor: Seeds from Italy, PO Box 3908, Lawrence, KS 66046; (785) 748-0959; www.growitalian.com
S	Seeds Trust, 5870 S. Long Lane, Littleton, CO 80121; (720) 335-3436; www.seedstrust.com
SW/SDW	Seedway, Inc., 99 Industrial Road, Elizabethtown, PA 17022; (800) 952-7333; Fax: (800) 645-2574; www.seedway.com
SE, SM, Sem	Seminis Inc., 2700 Camino Del Sol, Oxnard, CA 93030; (855) 733-3834; us.seminis.com

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Seed Code	Seed Company Name and Address
SO	Solar Seed Inc., 302 South Center St., Eustis, FL; (352) 357-5065
SVR/SE	Seneca Vegetable Research, 5267 Flat St., PO Box 128, Hall, NY 14463; (585) 526-7044; www.senecavegetable.com
SI/SG	Siegers Seed Company, 13031 Reflections Drive, Holland, MI 49424; (800) 962-4999; Fax: (616) 994-0333; www.siegers.com
SWS	Southwestern Vegetable Seed Co., LLC, PO Box 11449, Casa Grande, AZ 85230; (520) 836-7595; Fax: (520) 836-0117
ST	Stokes Seeds, PO Box 548, Buffalo, NY 14240-0548; (800) 396-9238; Fax: (800) 272-5560; www.stokeseeds.com
STE	Steele Plant Company, LLC, PO Box 191, 202 Collins St., Gleason, TN 38229; (731) 648-5476; www.sweetpotatoplant.com
SY/RG/ROG	Syngenta, PO Box 4188, Boise, ID 83704-4188; (208) 322-7272; syngenta-us.com/seeds/vegetables/
TN	Tainong Seeds, Inc., 1341 Distribution Way, #23, Vista, CA 92081; (760) 598-2348; Fax: (760) 598-1378; www.tainongseeds.com
TR	Territorial Seed Company, PO Box 158, Cottage Grove, OR 97424; (800) 626-0866; Fax: (888) 657-3131; www.territorialseed.com
TGS	Tomato Growers Supply Co., PO Box 60015, Fort Myers, FL 33906; (888) 478-7333**;** Fax: 888-768-3476; www.tomatogrowers.com
TT	Totally Tomatoes, 334 W. Stroud St., Randolph, WI 53956; (800) 345-5977; www.totallytomato.com
TS	Tozer Seeds, Pyports, Downside Bridge Road, Cobham, Surrey, KT11 3EH; www.tozerseeds.com
TW	Twilley Seeds Co., Inc., 121 Gary Road, Hodges, SC 29653; (800) 622-7333; www.twilleyseed.com
UG	United Genetics, 8000 Fairview Road, Hollister, CA 95023; (831) 636-4882; Fax: (831) 636-4883; www.unitedgenetics.com
UA	US Agriseeds, 3424 Roberto Court, San Luis Obispo, CA 93401; (800) 675-1034; Fax: (805) 547-9395; www.usagriseeds.com
US	US Seedless, LLC, 325 E. Walnut St., Perkasie, PA 18944; (877) 332-7733; Fax: (877) 261-1378; www.usseedless.com
VE	Vesey's Seeds, PO Box 9000, Charlottetown, PE, Canada, C1A 8K6; (800) 363-7333; Fax: (800) 686-0329; www.veseys.com
VL	Vilmorin North America 3 Harris Place, Salinas, CA 93901; (831) 771-1500; Fax: (831) 771-1517; www.vilmorin.us
WMK	Wannamaker Seeds, Inc., PO Box 85, Saluda, NC 28773; (828) 749-3784; www.wannamakerseeds.com

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Seed Code	Seed Company Name and Address
WI	Willhite Seed, Inc., PO Box 23, Poolville, TX 76487-0023; (800) 828-1840; Fax: (817) 599-5843; www.willhiteseed.com
WN	Western Seed Americas Inc., 303 South Collins St., Plant City, FL 33563; (813) 759-6404
WP	Wood Prairie Farm, 49 Kinney Road, Bridgewater, ME 04735; (800) 829-9765; Fax: (800) 300-6494; www.woodprairie.com

We would like to express our appreciation to the seed companies that provided seeds and support for these vegetable trials.

Evaluating West Virginia Organic Heritage Beans for Commercial Markets in West Virginia

Lewis W. Jett[1] West Virginia University, G215 Agriculture Sciences Bldg., Morgantown, WV 26506

Beans, corn and squash have been cultivated in the Appalachian mountains for thousands of years starting with the Native Americans and pioneers. Heirloom beans, in particular, are considered heritage crops by many West Virginians. Selected varieties have excellent horticultural traits that allow them to be well adapted to the mountain environment. There may also be an opportunity to produce heirloom beans for commercial markets in West Virginia.

Materials and Methods

The first of a series of evaluations began in early June 2015 when 12 varieties of West Virginia heirloom bean were planted at the WVU Organic Farm in Morgantown, West Virginia (Figure 1). Each seed was planted 4 inches apart in plots which were 5 feet long. Each variety was replicated 3 times in a randomized complete block experimental design. The varieties evaluated were indeterminate pole bean varieties with unique names and characteristics, such as *Turkey Craw, Rattlesnake, Logan Giant, Fat Man, October Tender Hull, Coal Camp, Williams River, Ground Squirrel, White Greasy Pole, Speckled Christmas, Aunt Glenda's Pole Bean,* and *Flood Bean*. Many of the varieties were obtained from Flanagan's Farm in Nicholas County, West Virginia. The beans were distinct colors ranging from black, brown and white to mottled seed coats (Figure 1). All varieties exhibited excellent growth and were easy to grow organically. All varieties were trellised using a mesh plastic trellis supported by metal posts. Weed control was achieved by growing the beans in a 4-mm-thick black ground cover mulch. The beans were fertilized at planting with an application of 4-3-4 pelletized organic poultry litter to apply a rate equivalent to 60lbs of N/acre. No additional fertilizer was applied to the planting. Insects were controlled using *Pyganic* insecticide. The beans' vigorous vines rapidly covered the trellises and were harvested after drying. Then, the beans were mechanically shelled and bagged in early October. Dry weight of the shelled beans was recorded. The beans were test marketed at the West Virginia Small Farms Conference in Charleston, WV in February 2016.

Figure 1. Heirloom beans were trellised and harvested as dry beans.

[1]WVU Commercial Horticulture Specialist

Results and Discussion

Some pole beans are dried in the pods and shelled for cooking. Most pole beans, bush beans and half runners are harvested fresh, and eaten or canned before the bean fills out when the pods are still tender. The objective of this project was to evaluate heritage pole beans as dry beans. Fresh beans could potentially yield more, but there would be significantly more harvest labor required. In addition, dry beans can be stored and sold over many months. The beans dried on the vines and were harvested in one picking. A mechanical sheller was used to shell the varieties. Fifty to sixty pounds of beans could be shelled in one hour. High-yielding varieties included *Logan Giant*, which produced a medium brown seed; *October Tender Hull*, which had a light brown seed with maroon streaks; and *Fat Man* and *White Greasy Pole*, which had high yields of white beans (Table 1). *Coal Camp* and *Williams River* were excellent black/brown beans.

Winter markets, such as farmers markets, CSA (Community Supported Agriculture) and restaurants, are viable market outlets for heirloom dry beans. Organic heirloom beans can be sold for $3-4/lb. Sales at the "Winter Blues Farmer's Market" at the West Virginia Small Farms Conference were very good. Consumers preferred mixed varieties of beans with a diversity of colors.

Preserving Heirloom Beans

West Virginians have selected and saved seeds from beans varieties for generations. Heirloom varieties, diverse with unique color and flavor, are genetic treasures that must be preserved for future gardeners not only in the Appalachian region, but the entire world.

When saving bean seeds, it is important to isolate varieties by 25 to 50 feet. The beans can be dried in the pods on the plant, or taken inside and dried before shelling. The seeds should be stored in jars or plastic bags in a cool location until planting the following spring or summer.

Table 1. Evaluation of heirloom West Virginia beans.

Variety	Wt. (dry) ozs.[z]	lbs./acre	Seed Color
Aunt Glenda's	16.4	2233	Brown/Red Mottled
Coal Camp	14.6	1987	Brown/Black
Fatman	19.6	2668	White
Flood	16.8	2287	Black
Greasy Pole	21.3	2900	White
Ground Squirrel	11.0	1497	Brown/Black Streaks
Logan Giant	17.3	2355	Brown
Oct. Tender Hull	20.5	2791	Light brown with maroon streaks
Rattlesnake	12.9	1756	Brown/Black Streaks
Speckled Christmas	4.1	558	Mottled
Turkey Craw	15.1	2056	Brown
Williams River	13.0	1770	White
Average	*15.3*	*2083*	
Standard error	*0.9*	*123*	

[z]Yield/20ft^2

Muskmelon Variety Trial in Southwest Indiana — 2016

Wenjing Guan, Daniel S. Egel and Dennis Nowaskie, Southwest Purdue Agricultural Center, Vincennes, IN, 47591 guan40@purdue.edu

Indiana ranks fifth in 2015 in cantaloupe production in the United States. A total of 1,700 acres were harvested, with production about 272,000 cwt. The yield of cantaloupe per acre in Indiana decreased from 220 cwt in 2014 to 160 cwt in 2015, while the price per cwt increased from $15.1 to $28.0 (USDA, 2016a). Production value of cantaloupes in Indiana was about $7.6 million in 2015, which accounted for about 14% of the value of fresh market vegetables in Indiana (USDA, 2016b). Cantaloupes grown in Indiana are primarily eastern types that form tan-colored netting and develop an identifiable abscission zone during ripening. Long-shelf life varieties that are recently introduced in the market are also tested in this variety trial.

Materials and Methods

Seed sources of the 12 cantaloupe varieties are provided in Table 1. Among them, 'Durawest', 'Infinite Gold', 'NUN 26181' and 'NUN 26191' are long shelf-life (LSL) cantaloupes. Seeds of all the varieties were planted into 50-cell black seeding flats (T.O. Plastics, Clearwater, MN) on 15 April 2015, using a peat-based potting media (Metro-Mix 360, a mixture of sphagnum peat moss, coarse perlite, bark ash, starter fertilizer and dolomite). Transplants were produced in a greenhouse at the Southwest Purdue Agricultural Center (SWPAC). Plants were transplanted to the field on 23 May 2015.

Soil type of the experimental site is Ade loamy fine sand. Previous crop (2015) was soybeans. Randomized complete block design with three blocks and 20 plants per variety per plot was used in the study. Plants were grown in raised beds covered with black plastic mulch. Drip tape with a 12-inch emitter spacing and flow rate of 0.22 gpm/100 ft was used for irrigation. Bed spacing and in-row spacing were 6 and 2.5 ft, respectively. Fertilizers at the rate of 250 lb/acre urea (46-0-0), 150 lb/acre potash (0-0-60), 100 lb/acre diammonium phosphate (18-46-0), 200 lb/acre dolomite lime, 100 lb/acre K-Mag granular, 7 lb/acre boron 14.3% and 20 lb/acre Zinc 10% LS were pre-plant broadcast applied. During transplanting, each plant received approximately one cup of starter fertilizer solution (Miracle-Gro, 4.7 grams per gallon water). Diseases and insects were managed using recommendations from Melcast (melcast.info) and *Midwest Vegetable Production Guide for Commercial Growers* (Egel et al., 2016).

Plants were harvested three times a week from 11 July to 5 Aug. Eastern-type cantaloupes were harvested at half to full slip stage. Fruit was weighted individually. Nine fully ripe fruit from each variety were collected during peak harvest for the evaluation of fruit quality attributes. Fruit size, seed cavity size, rind thickness, total soluble solids, flesh firmness were recorded. Data analysis of variance was performed using the Proc Mixed procedure of SAS. Fisher's least significant difference test ($\alpha = 0.05$) was conducted for multiple comparisons of different measurements among cantaloupe varieties.

Results and Discussion

Eastern-type cantaloupe

Marketable yield of eastern-type muskmelon varieties ranged from 23,920 to 44,269 lb per acre. 'ME3716' yielded 44,269 lb/acre, significantly higher than other varieties except 'Aphrodite'. 'ME3716' and 'Athena' produced the most marketable fruit (Table 2). 'Sweet East' and 'Athena' had the highest yield in the first week's harvest. 'Aphrodite' and 'ME3716' had the highest yield in the fourth week's harvest (Table 3 and Fig. 1). Average fruit size of eastern-type muskmelons ranged from 5.77 to 8.34 lb. 'Aphrodite' had the largest average fruit size (8.34 lb), followed by 'Maxi East' (8.28 lb), and 'IM 183' (7.95 lb), which had about 50% of the fruit larger than 8 lb (Table 4, Fig. 2).

'Maxi East' (12.02 °Brix) and 'SV5196MF' (12.3 °Brix) had significantly higher total soluble solids compared with other varieties. 'SV5196MF' had firmer flesh than other eastern-type muskmelons. Flesh firmness of eastern-type melons was less than 5 lbs-force except 'SV5196MF' and 'Sweet East' (Table 4). 'Aphrodite' had relatively large seed cavities, while seed cavities of 'Athena', 'ME3743', and 'ME3716' were smaller (Table 4).

Long shelf-life cantaloupe

The yield of LSL varieties ranged from 29,160 to 34,459 lb/acre, in the same range as eastern-type muskmelons. No significant differences in fruit weight were observed among varieties. Fruit number of 'Durawest' was less than other varieties (Table 5). Fruit size of LSL varieties was in the range of 3.97 to 6.67 lb, with 'Durawest' the largest and 'NUN 2618' the smallest (Table 6). Percentages of the number of fruit in weight categories are presented in Fig.3.

Total soluble solids of LSL varieties were similar among varieties, and they were all above 11 °Brix. The firmness of all the LSL varieties was above 5 lbs-force, with the values of 'Infinite Gold' and 'Durawest' significantly higher than 'NUN 2618' and 'NUN 2619'.

Long shelf-life muskmelons last longer in the field. They can be harvested less frequently compared with eastern-type muskmelons. Because LSL muskmelons have delayed abscission and do not change color significantly, the same criteria for determining the ripeness of traditional eastern-type melons were not applied to the LSL muskmelons. Indicators used to determine the ripeness of LSL include a few vertical cracks form on the peduncle (the stem adjacent to the fruit) but fruit has not slipped yet. In addition, keeping track of days from direct sowing or transplanting is recommended to estimate the right harvest date. In this trial, we harvested 'Infinite Gold' and 'Durawest' about 10 days later than the first harvest of eastern-type muskmelons. LSL variety NUN 26181 and NUN 26191 change color from green to yellow before they are fully ripe. But the best quality fruit should be harvested when the rind turns dark yellow to almost orange.

Acknowledgements

The authors would like to thank Larry Sutterer, Bill Davis, Angie Thompson, Curtis Marchino, Barbara Joyner for their invaluable technical assistance with the variety trial, and the seed companies involved for their financial support.

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USDA, 2016b. 2015 State Agriculture Overview, Indiana. 31 Oct.2016. < https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=INDIANA>.

Table 1. Varieties and seed sources of muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Variety	Seed company	Notes[z]
Aphrodite	Syngenta	
Athena	Syngenta	
Durawest	Nunhems/Bayer	LSL
IM 183	Clifton	
Infinite Gold	Sakata	LSL
Maxi East	Nunhems/Bayer	
ME3716 (Astound)	Syngenta	
ME3743 (Accolade)	Syngenta	
NUN 26181	Nunhems/Bayer	LSL
NUN 26191	Nunhems/Bayer	LSL
SV5196MF	Seminis	
Sweet East	Nunhems/Bayer	

[z]LSL: long shelf-life type muskmelons

Table 2. Marketable and total yields of eastern-type muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Variety	Marketable yield				Total yield		
	Weight (lb) per acre		Number of fruit per acre		*Weight (lb) per acre*	*Number of fruit per acre*	
Aphrodite	43,068	ab	5,179	cd	49,280 a	6,098	bc
Athena	34,728	bc	6,001	ab	42,463 a	7,550	ab
Maxi East	31,229	cd	3,775	d	41,523 a	5,324	c
ME3743	34,062	bc	5,420	bc	42,746 a	7,212	ab
ME3716	44,269	a	7,066	a	50,849 a	8,615	a
IM 183	28,769	cd	3,630	d	45,145 a	5,856	bc
SV5196MF	23,920	d	3,872	d	28,393 a	4,792	c
Sweet East	33,204	cd	4,453	cd	40,792 a	5,856	bc

[z.]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 3. Yields of eastern-type muskmelon varieties harvested in each week in the 2016 muskmelon variety trial in southwest Indiana.

Variety	First week				Second week				Third week				Fourth week			
	Weight (lb) per acre		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*	
Aphrodite	609	c[z]	97	b	16,841	a	2,081	ab	15,023	ab	1,694	bc	10,595	a	1,307	ab
Athena	2,980	a	677	a	14,927	a	2,614	ab	9,806	bc	1,549	bc	7,015	ab	1,162	abc
Maxi East	914	bc	193	b	4,689	b	629	c	18,513	a	2,081	ab	7,113	ab	871	bcde
ME3743	2,450	ab	532	a	13,863	a	2,275	ab	11,868	abc	1,646	bc	5,881	bc	968	abcd
ME3716	445	c	97	b	15,932	a	2,662	a	17,615	a	2,710	a	10,276	a	1,597	a
IM 183	1,366	bc	242	b	12,056	ab	1,549	bc	12,825	abc	1,452	bc	2,523	c	387	de
SV5196MF	163	c	48	b	11,578	ab	1,984	ab	8,104	c	1,210	c	4,074	bc	629	cde
Sweet East	2,994	a	581	a	12,812	a	1,597	abc	15,508	ab	2,033	abc	1,889	c	242	e

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 4. Fruit quality of eastern-type muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Variety	Average fruit size (lb)		Total soluble solids (°Brix)		Firmness (lbs-force)		Rind (in)		Fruit length (in)		Fruit width (in)		Seed cavity length (in)		Seed cavity width (in)	
Aphrodite	8.34	a	9.82	b	3.39	d	0.36	b	7.93	bc	7.72	ab	5.21	ab	4.14	a
Athena	5.77	c	9.92	b	3.64	cd	0.45	a	7.65	cd	6.88	c	4.72	c	3.03	bc
Maxi East	8.28	a	12.02	a	4.46	bcd	0.35	b	8.41	ab	7.33	bc	5.35	a	3.21	bc
ME3743	6.27	c	10.23	b	4.97	bc	0.49	a	7.63	cd	6.95	c	4.47	c	3.27	bc
ME3716	6.22	c	9.65	b	4.88	bc	0.48	a	7.23	d	6.71	c	4.40	c	2.61	c
IM 183	7.95	ab	9.15	b	4.19	bcd	0.38	b	8.44	ab	8.07	a	5.20	ab	3.48	ab
SV5196MF	6.17	c	12.3	a	7.41	a	0.29	c	7.64	cd	6.84	c	4.81	bc	2.64	bc
Sweet East	7.44	b	10.2	b	5.63	b	0.36	b	8.75	a	7.36	abc	5.32	a	2.80	bc

[z.] Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 5. Marketable and total yields of long shelf-life muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Variety	**Marketable yield**			**Total yield**		
	Weight (lb) per acre	*Number of fruit per acre*		*Weight (lb) per acre*	*Number of fruit per acre*	
Infinite Gold	34,459 a	6,292	b	38,159 a	7,018	b
Nun 26181	33,344 a	8,373	a	37,600 a	9,486	a
Nun 26191	32,217 a	6,147	b	38,665 a	7,454	b
Durawest	29,160 a	4,404	c	31,669 a	4,888	c

[z] Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 6. Fruit quality of long shelf-life muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Variety	Average fruit size (lb)		Total soluble solids (°Brix)		Firmness (lbs-force)		Rind (in)		Fruit length (in)		Fruit width (in)		Seed cavity length (in)		Seed cavity width (in)	
Infinite Gold	5.52	b[z]	12.23	a	8.37	a	0.30	a	7.42	a	6.43	b	4.82	a	2.80	a
Nun 26181	3.97	c	11.17	a	5.37	b	0.33	a	8.31	a	5.68	c	3.96	b	1.94	c
Nun 26191	5.23	b	11.97	a	5.38	b	0.38	a	6.96	a	6.36	b	4.26	b	2.14	b
Durawest	6.67	a	11.90	a	7.54	a	0.19	b	8.12	a	6.99	a	5.28	a	2.68	a

[z.] Means within a column followed by the same letter are ont significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

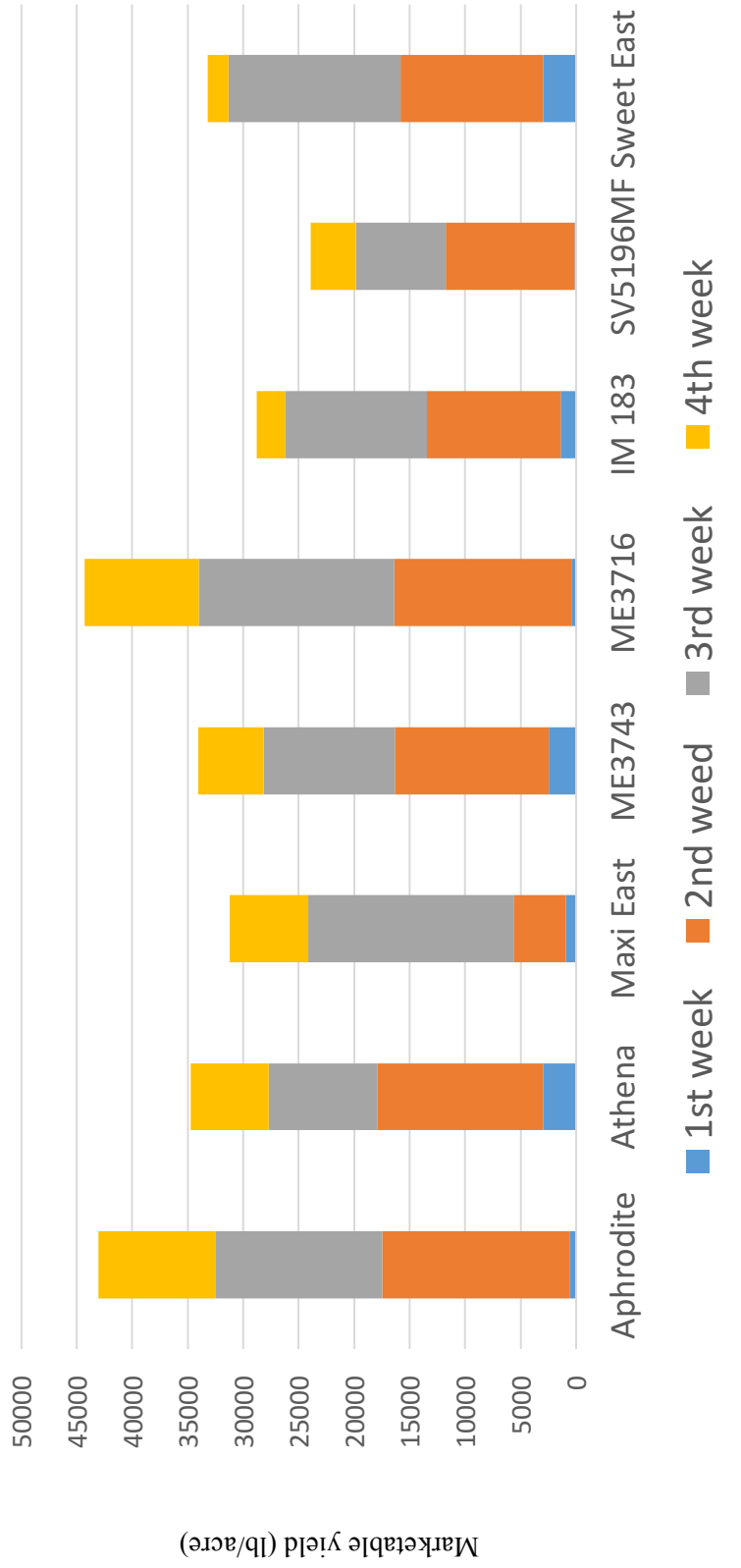

Figure 1. Yield of eastern-type cantaloupes harvested in each week in the 2016 cantaloupe variety trial in southwest Indiana.

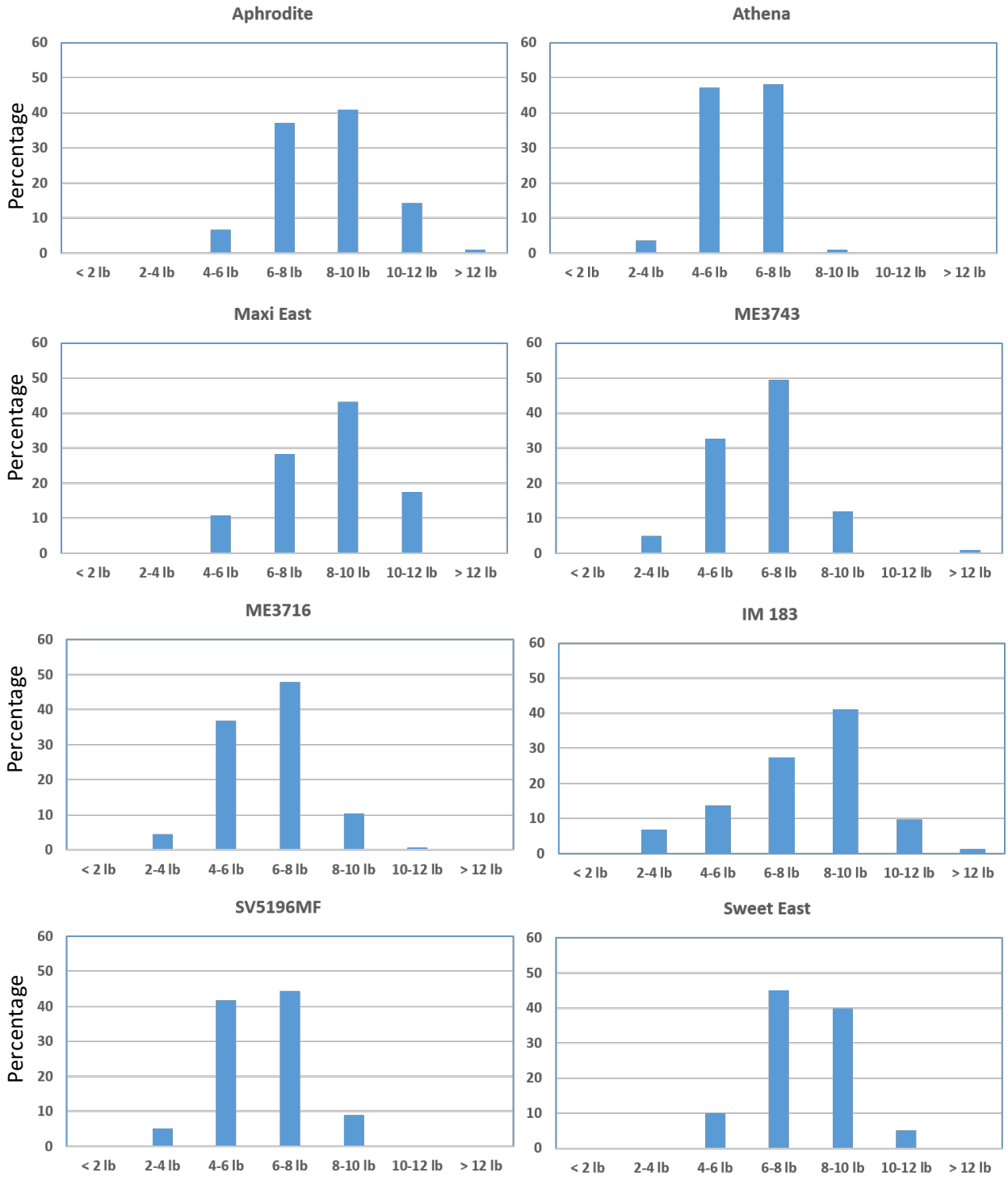

Figure 2. Percentages of the number of eastern-type muskmelons in each weight category in the 2016 muskmelon variety trial in southwest Indiana.

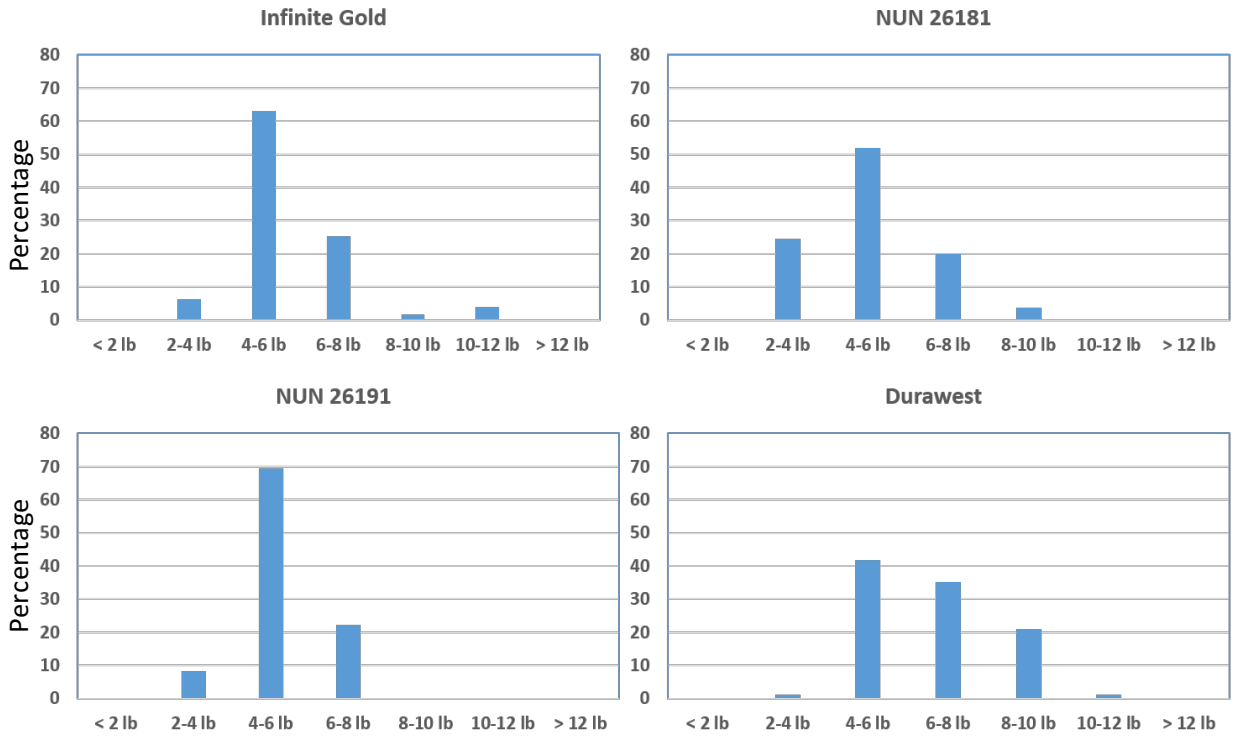

Figure 3. Percentages of the number of long shelf-life muskmelons in each weight category in the 2016 muskmelon variety trial in southwest Indiana.

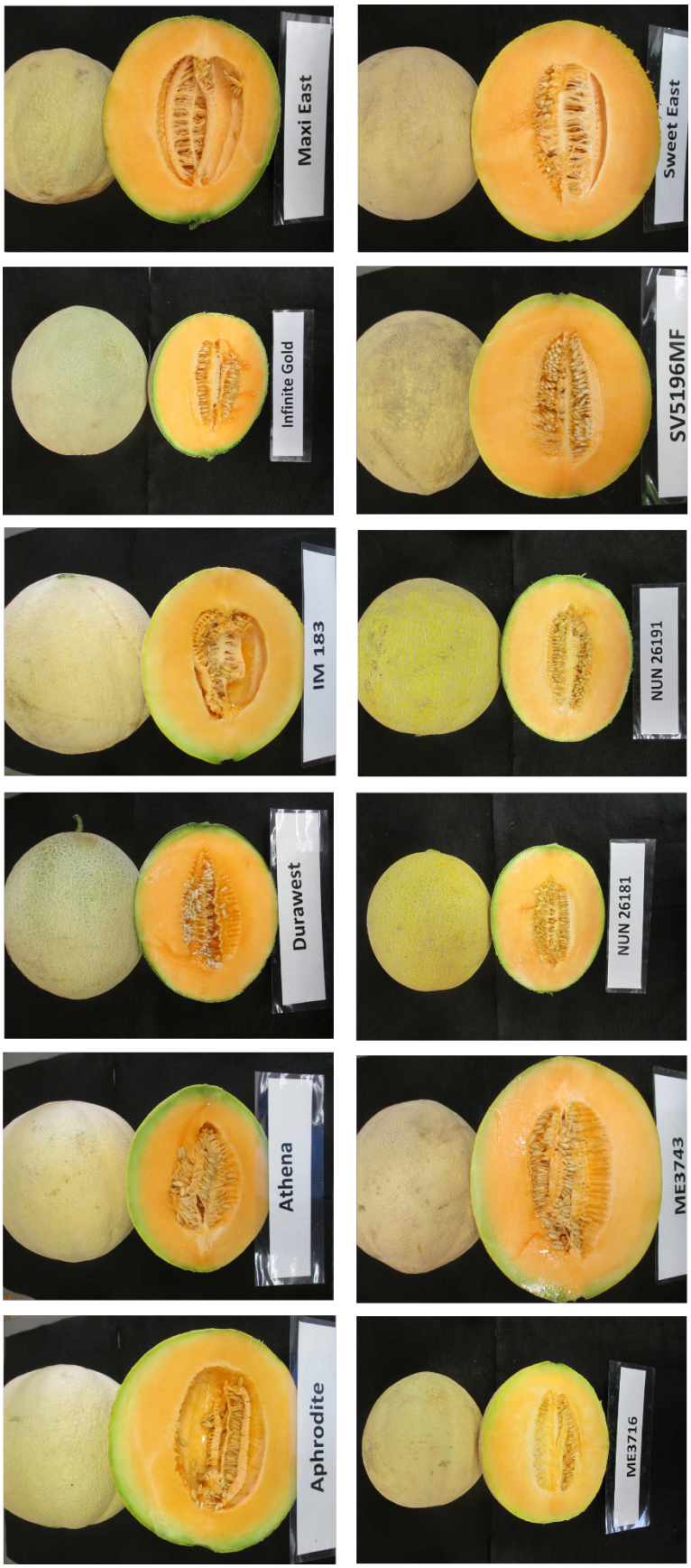

Figure 4. Exterior and interior of muskmelon varieties in the 2016 muskmelon variety trial in southwest Indiana.

Cantaloupe Variety Trial for Kentucky, 2016

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Cantaloupe is the fifth largest fresh market vegetable crop produced in Kentucky (USDA, 2013). It is a popular summer crop grown in many areas of the state and is commonly found at farmers markets and produce auctions. Although there continues to be standard varieties produced in the state, evaluation of new varieties is important to find those with improved fruit quality, yield, and shelf life. The objective of the trial was to evaluate yield, fruit quality, and maturity for fourteen different cantaloupe varieties.

Materials and Methods

On 14 April seeding of the cantaloupe varieties began using 50-cell black seedling flats (Landmark Plastic, Akron, OH). The seeding media used was Jiffy-Mix #17 (Jiffy Products of America, Lorain, Ohio), which is a common peat based substrate designed for vegetable transplant production. Due to the poor germination of a few of the varieties, a second seeding occurred on 20 April, using the same methods, with much better results. On a commercial production farm in Scott County on 19 May, each of the fourteen varieties was transplanted in the assigned plot into Maury silt loam soil. Transplanting was executed using a Rain-Flo waterwheel setter, with a water-soluble transplant fertilizer mixed into the water. The plots were 6 ft apart, 50 ft in length, with 20 plants in each plot spaced 30 in apart. At the end of each plot was a 10 ft break in order to have the plots separated and to have room to easily gain access to each plot. A plasticulture production system was employed using black plastic mulch-covered (4 ft. x 1 mil, Filmtech Plastics of the Sigma Plastics Group, Lyndhurst, NJ) raised beds with drip tape (12 in. emitter spacing, 30 gph/100 ft., Aqua Traxx, The Toro Company, Bloomington, MN). Using a Rain-Flo plastic layer/ bed shaper, plastic mulch and drip tape was installed on 15 April. Urea (46-0-0) was applied at a rate of 110 lbs to the acre and muriate of potash (0-0-60) was applied at a rate of 83.5 lbs to the acre as pre-plant fertilizer. Starting on 27 May fertigation occurred every week using calcium nitrate until 1 July, at which time potassium nitrate was applied until 22 July and then, for the last two fertigation events until 5 August, calcium nitrate was used again. At each fertigation event 9 lbs of nitrogen per acre were applied, based on the recommended rate of actual nitrogen for the season. Fertilization, diseases, and arthropod pests were managed using recommendations in the ID-36 *Vegetable Production Guide for Commercial Growers* (Saha et. al., 2015). Preventative fungicide applications were determined using MELCAST (Egel and Latin, 2012). Insecticide applications were based on weekly scouting reports throughout the production season.

Beginning on 13 July and terminating on 8 August, fruit was harvested three times per week for a total of 12 harvests. Every fruit harvested was then weighed and nine fruit from each variety, three for each replication, were then sampled for fruit quality on the same day, including brix (soluble solids), firmness, and other internal parameters. Measuring fruit firmness was done

with an analog penetrometer (FT, Wagner Instruments, Greenwich, Connecticut). A manual refractometer (RF-12, Extech Instruments, Nashua, New Hampshire) was used for measuring soluble solids. Yield data were analyzed by general linear model and means were separated by Fisher's least significant difference test using SAS statistical programs (SAS Institute, Cary, NC).

Results and Discussion

Yields in 2016 were increased, ranging from 2,468 to 7696 fruit to the acre compared to 1600 to 6,490 fruit in 2105 (Table 1) (Saha, 2015). The increase in yield from 2015 to 2016 was likely due to the comparative reduction of rainfall over the 2016 growing season. Average precipitation in July in Scott County is 4.65 inches; in 2016 4.98 inches fell (Weather Underground, 2016). 2015 was an extremely wet season in July with nearly double the average rain fall for the month. Comparatively, rainfall in July 2016 was close to the annual average for the month. These relatively drier conditions allowed for timely preventative fungicide applications and more fertigation events than in the 2015 growing season, ultimately leading to more fruit set.

In terms of fruit count 8H2111 was the standout when compared to industry standards Aphrodite and Athena, with 7696 fruit/A (Table 1). Average fruit weights ranged from 5.4 to 8.4 pounds (Table 1). Orange Sherbet and Aphrodite had greater average fruit weights when compared to the other varieties, with the exception of 8H229 (Table 1). All other varieties excluding UGR1037-11, 8260b, and UGR1727-13 were comparable to Athena in terms of average fruit weight (Table 1). 8H2111 had the highest yield by weight as compared to all other varieties (Table 1). Varieties that were comparable to Aphrodite with respect to fruit weight per acre were UGR1037-11, 8H245, ME3743, ME3716, 8H277, UGR2101-14, and Orange Sherbet.

SV5196MF had significantly greater soluble solids (14° Brix) as compared to all other varieties other than UGR1037-11 (Table 2). However, it had the lowest numerical fruit number per acre as compared to all other varieties. UGR1037-11 and 8H277 had statistically higher brix as compared to both standards and comparable yield. Further 8H277 had an average fruit weight of 7.1 lbs which is the typical desirable size. SV5196MF, UGR1037-11, 8260b, UGR2101-14, and 8H229 had statistically greater firmness than Aphrodite and all other evaluated varieties. 8H277 and 8H211 had firmness statistically the same as Athena, while UG- 1037-11 was slightly more firm (Table 2).

Yields from industry standard Aphrodite and Athena prove why they have become the standards. 8H211 was comparable in soluble solids and average fruit weight with the standards and better in terms of number of fruit and fruit weight. Orange Sherbet and 8H229 were comparable to Aphrodite with respect to yield and quality. Orange Sherbet is a Tuscan type that can be substituted for the standards for individuals that are direct marketing. Variety selection is largely dictated by market. Based on this season's results, wholesalers should likely continue with Aphrodite and Athena, but could explore using 8H211 and 8H277 instead once released, because they are comparable; Direct marketers, such as those utilizing farmers markets and

roadside stands, could consider other possibilities. For example, many of the Tuscan types such as Orange Sherbet are of excellent quality and are comparable in terms of yield. Although a bit smaller UGR1037-11 (5.4 lbs) also had good yield and fruit quality, which may be worth consideration for direct marketers as well.

Acknowledgements

The authors would like to extend their appreciation to the following for support for the completion of the project: Vegetable Extension Farm Crew, Horticulture Research Farm Staff, Kentucky Department of Agriculture, Kentucky Vegetable Growers Association, Jiffy, and Origene, United Genetics, Seminis, and Syngenta for submitting their varieties.

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Table 1. Marketable Yield of cantaloupe varieties, 2016.

Variety	Seed Company	Number of Fruit per plot[z]		Average Fruit Weight (lbs)		Total Fruit Weight (lbs) per plot		Number of Fruit per acre		Total Fruit Weight (lbs) per acre	
8H2111	OG	53.0	A[y]	6.9	CDE	357.3	A	7695.6	A	51887	A
ME3716	SY	38.3	B	6.8	CDE	260.3	B	5566.0	B	37792	B
UGR1037-11	UG	37.7	B	5.4	G	202.2	BCD	5469.2	B	29364	BCD
8H245	OG	35.7	BC	6.3	EF	224.2	BCD	5178.8	BC	32553	BCD
ME3743	SY	35.0	BCD	7.4	BC	257.9	B	5082.0	BCD	37452	B
8H277	OG	34.3	BCD	7.1	CD	243.6	BC	4985.2	BCD	35368	BC
UGR2101-14	UG	32.7	BCD	6.3	EF	204.8	BCD	4743.2	BCD	29730	BCD
Aphrodite	SY	30.0	BCDE	8.4	A	252.0	BC	4356.0	BCDE	36594	BC
Orange Sherbet	SI	26.0	BCDEF	8.4	A	214.4	BCD	3775.2	BCDE	31129	BCD
Athena	SY	24.3	CDEF	6.7	CDE	159.9	DE	3533.2	CDEF	23215	DE
8H229	OG	22.7	DEF	8.1	AB	183.0	CD	3291.2	DEF	26567	CD
8260b	OG	19.3	EF	5.4	G	102.6	E	2807.2	EF	14893	E
UGR1727-13[x]	UG	18.7	EF	5.8	FG	107.6	E	2710.4	EF	15618	E
SV5196MF	S	17.0	F	6.4	DEF	108.6	E	2468.4	F	15765	E

[z]Plot size: 300 ft^2

[y]Means in columns separated by Fisher's least significant test ($P \leq 0.05$), means with same letter are not significantly different.

[x]Galia-Type

Table 2. Fruit quality of cantaloupe varieties, 2016.

Variety	Seed Company	Brix (% Soluble Solids)		Seed Cavity Length (in)		Seed Cavity Width (in)		Firmness (lbs-force)		Overall Length (in)		Overall Width (in)	
SV5196MF	S	14.0	A[z]	4.5	CDE	2.9	ABC	4.7	AB	6.9	E	6.4	C
UGR1037-11	UG	13.4	AB	4.1	DEF	2.8	ABCD	4.1	BCDE	6.9	E	5.8	D
8H277	OG	12.9	BC	5.4	AB	3.1	AB	3.3	EFGH	8.8	A	6.9	AB
8260b	OG	12.2	CD	4.3	CDEF	2.2	E	5.0	A	7.3	DE	6.7	ABC
UGR2101-14	UG	12.1	CD	2.9	I	2.4	CDE	3.7	CDEF	5.5	F	5.5	D
8H229	OG	11.7	DE	4.9	BC	2.4	CDE	4.4	ABC	8.2	ABC	7.0	A
Orange Sherbet	SI	11.6	DE	5.7	A	3.3	A	3.4	EFG	8.3	AB	6.6	ABC
8H245	OG	11.5	DE	4.7	CD	2.3	DE	3.2	FGH	7.5	CDE	6.8	ABC
Athena	SY	11.5	DE	3.1	HI	2.6	BCDE	2.8	GH	5.4	F	5.6	D
ME3743	SY	10.9	EF	3.3	GHI	2.6	BCDE	4.2	ABCD	5.9	F	5.8	D
8H2111	OG	10.8	EFG	4.7	BCD	2.6	BCDE	3.5	DEFG	8.0	BCD	6.9	AB
Aphrodite	SY	10.8	EFG	3.7	FGH	3.3	A	2.5	H	6.0	F	6.4	BC
ME3716	SY	10.3	FG	3.9	EFG	3.0	AB	3.6	DEFG	6.9	E	6.3	C
UGR1727-13[Y]	UG	9.8	G	4.1	DEF	2.2	E	3.1	FGH	7.0	E	6.5	ABC

[z]Means in columns separated by Fisher's least significant test ($P \leq 0.05$), means with same letter are not significantly different.
[Y]Galia type

2016 Evaluation of Standard Pickling Cucumber Varieties in Kansas

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Summary

Cucumbers are the fourth most popular specialty crop grown in Kansas and are sold through farmers markets, CSA's, on-farm sales, wholesale markets and restaurant sales. The goal of this study was to investigate the performance of 6 standard (non-parthenocarpic) pickling cucumber varieties ('Calypso,' 'Carolina,' 'Fancipak,' 'Supremo,' 'Eureka,' and 'SMR58') in Kansas. Total number of fruit per plant ranged from 18 to 31. 'Fancipak' had the highest total number per plant at 31 and was statistically similar to 'Calypso'. 'SMR58' had the lowest total fruit number at 18 and was not statistically similar to other varieties ($P<0.05$).

Materials and Methods

The pickling cucumber variety trial was planted approximately 30 miles Southwest of Kansas City, at the Kansas State University Olathe Horticulture Research and Extension Center. Seeds were sown directly on 5 May, 2015 into two raised plasticulture beds planted at 6 foot centers. Each trial consisted of 8 plants sown at 18-inch row spacing. Seeds were re-sown as necessary. No trellis system was used and plants were allowed to vine on the ground. An initial insecticide (Assail) was applied on 4 June. On 26 June, potassium nitrate was applied at a rate of 15lbs. N/acre. Harvesting was carried out three times weekly from 26 June to 27 July. At each harvest, fruit were graded for marketability with number and weight of marketable and cull fruit recorded. Additionally, 10 marketable cucumbers were chosen randomly from each plot to determine fruit characteristics. Length, diameter, color (light, medium, dark, or yellow), and USDA Handbook 66 grade (1, 2, 3, or oversized) were recorded. If there were fewer than 10 cucumbers per plot, all marketable cucumbers were recorded.

Average fruit size and percent marketability were determined and are presented below. All data was analyzed using ANOVA (PlotIt, Scientific Programming Enterprises, Haslett, MI), and a mean separation test was carried out by using an F-protected least significant difference (LSD) test. A separate analysis was carried out for each individual observation and the results of the LSD test are shown where statistically significant treatment effects occurred.

Results and Discussion

Peak harvest of marketable fruit occurred on 6 July with 'Fancipak' being the highest at 3.4 marketable fruit number per plant. 'Supremo' and 'Calypso' were the second and third highest at 3.1 and 3 marketable fruit number per plant (data not shown). A second peak occurred on 13 July, again with 'Fancipak' being the highest at 3.1 of marketable fruit number per plant with 'Eureka' and 'Supremo' behind at 2.8 and 2.6 respectively (data not shown). As the season progressed, the incidence of fruit rot, curving, and crooked fruit occurred among all 6 varieties. 'Fancipak' had the highest per plant total and marketable yield; however, the marketable yield was statistically similar to 'Supremo' and 'Calypso'. 'Calypso', 'Carolina', 'Eureka', and

'Supremo' all had statistically similar marketable yields. 'SMR58' had the lowest marketable yield and was not statistically similar to any of the other varieties. There was no statistical difference in the average marketable fruit size between all 6 varieties (Figure 1). Based upon the 10 randomly selected cucumbers, 'Eureka' and 'Supremo' tended to produce a darker colored cucumber while all other varieties tended to produce medium and light colored fruit. The highest amount of light colored fruit was found with 'Calypso' at 66% of the samples being light colored (Figure 2).

Acknowledgements

We sincerely thank the Kansas Vegetable Growers Association for their support of this project. Seeds were donated by US Agriseeds. Additionally, we would like to thank Tracy Oelschlaeger, Cameron Smith, and the Kansas State University Olathe Horticulture Research and Extension Center for their assistance with this project.

Seed Sources

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Table 1. Marketable and total per plant fruit yield of pickling cucumber varieties grown in Olathe, Kansas.

Variety	Marketable				Total			
	Number		Wt (lbs)		Number		Wt (lbs)	
Fancipak	23.9	c	3.36	c	30.6	c	4.81	bc
Supremo	21.6	bc	2.94	bc	25.4	b	3.78	ab
Calypso	19.5	b	2.94	bc	26.3	bc	4.96	c
Eureka	18.4	b	2.65	b	23.1	b	3.75	ab
Carolina	18.1	b	2.57	b	25.3	b	4.81	bc
SMR58	11.7	a	1.58	a	17.9	a	3.55	ab

Table 2. Mean pickling cucumber fruit size (lbs) and marketability of pickling cucumbers in Olathe, Kansas.

Variety	Average Fruit Size (lbs)				Percent Marketability			
	Marketable		Total		Number		Weight	
Calypso	0.15		0.19	b	73.4%	bc	58.9%	b
Eureka	0.15		0.16	a	79.7%	de	70.8%	c
Carolina	0.14		0.19	b	71.4%	b	53.4%	b
Fancipak	0.14		0.16	a	78.2%	cd	70.9%	c
SMR58	0.14		0.20	b	63.7%	a	44.0%	a
Supremo	0.14		0.15	a	85.3%	e	78.1%	c

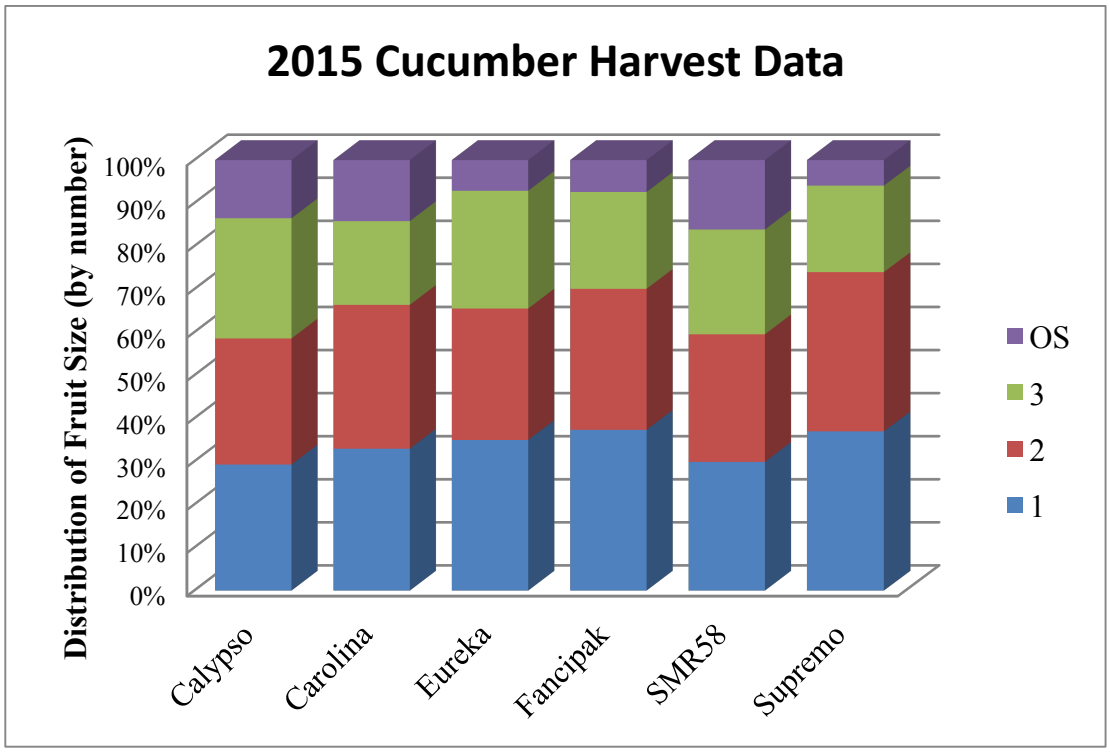

Figure 1. Distribution of Fruit Size (by Number)

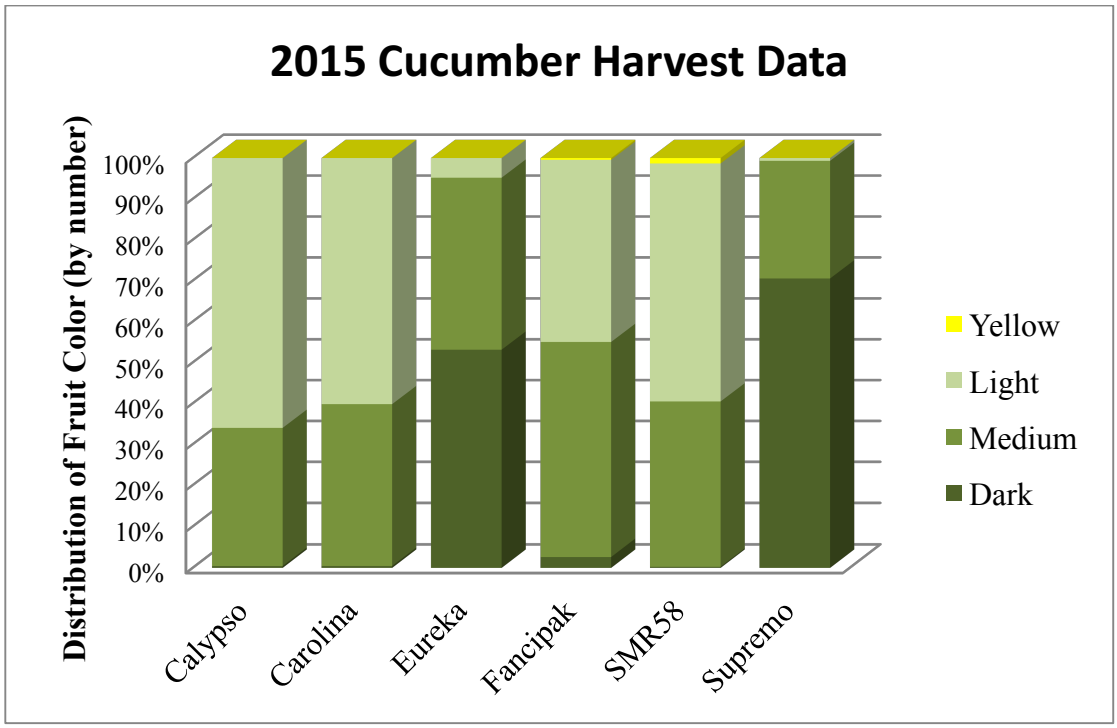

Figure 2. Distribution of Fruit Color (by number)

MSU 2016 Seedless Pickling Cucumber Variety Trial

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A pickling cucumber variety trial was planted at LaRaCha Farms (43.405717, -83.742582, Reese, Michigan). Rijk Zwaan seed company donated parthenocarpic (seedless) cucumber seeds for the trial.

On 10 June, 2016, 12 varieties were randomized, and planted side-by-side in three, 235 ft passes through a 12-row wing section of a 36-row John Deere DB-60 planter. The remaining 24 rows were filled with other seedless varieties. The planter was set for 20 inch between row spacing and 10 inch in row spacing, targeting 27000 seeds per acre. The soil type was a loam-loamy sand complex with 0-3% slope, typical of the pickling cucumber-growing region of Michigan's Saginaw Valley. Previous crop was sugar beets.

Curbit (2pt/a), and 50 lb of N from 28% urea was applied to the disced field approximately two weeks before planting. An additional 11 lb of N was injected 2 x 2 at planting in a liquid starter fertilizer blend. The cucumbers were cultivated 4 July, before tip-over. One protective downy mildew spray occurred 12 July (Orondia A 2 oz/a + Orondis B 32 oz/a).

Cultivars RZ68, RZ69, RZ65, RZ62, and RZ60 were harvested on 26 July (day 46), and the remaining varieties were harvested on 29 July (day 49). Harvest transects were 20 ft long sections of rows that were measured inside each of the three 235 ft subplots. Transects were determined by scouting each row for the most uniform stand. Each transect was destructively harvested by hand, and all fruit were sent through a sorter to separate into size classes: 4s (> 2" in diameter), 3Bs (1.75 - 2"), 3As (1.5 - 1.75"), 2Bs (1.25 – 1.5"), 2As (1.0625 – 1.25"), and 1s (0.5 – 1.0625"). Harvest weights, L:D ratios, and cull tallies of each size class were measured. Fruit per plant, and total bushel/acre yield calculations includes culls. L:D ratios were measured from ten cucumbers per size class. If there were fewer than ten cucumbers in a size class, they were all measured. Hollow centers were measured on 3Bs, and 3As by cutting cucumbers transversally in three places; stem end, center, and flower end. Gross revenue estimates were calculated using the following prices: $409.06/ton of 2A,Bs, $273.46/ton of 3A,Bs, and $22.60/ton of 4s).

Results

In general, the germination of all varieties was poor due to dry weather after planting. Harvests were taken where the most uniform stand occurred, and the third replication was omitted because of poor stand. Conclusions should be drawn cautiously.

RZ65 was the highest yielding variety in the 3A and 2B size classes, and was the highest yielder overall with the most fruit per plant (Table 1). Cull rates were between 9% and 40%, depending on the variety (Table 2). Culls were primarily from crooked fruit across all varieties. However, 'Bowie', RZ64, RZ66 and RZ61 had a disproportionately high level of hollow centers compared to other varieties.

Table 1 Performance in fruit per plant, plants per acre, and bushels per acre of twelve pickling cucumber cultivars planted at LaRaCha Farms, Reese, Michigan. [1] Fruit/plant and total bushels/acre includes culls, but excludes 1s. [2] Means differing by more than this amount are significantly different at α=0.05, based on Fisher's LSD.

2016			Bushels/Acre						
Variety	$/Acre	Total[1]	4	3B	3A	2B	2A	Fruit/ Plant[1]	Plants/ Acre
RZ65	$4407	604	16.7	176	244	143	24.1	3.62	27918
RZ60	$3669	488	0.00	132	212	118	26.6	3.14	27918
RZ67	$2700	452	61.3	212	147	29.7	2.48	2.56	25542
RZ62	$3142	441	5.57	166	184	79.2	6.81	3.00	25542
RZ61	$2880	431	27.8	130	207	46.4	20.4	2.48	27324
Gershwin	$2859	412	27.8	142	142	81.1	19.2	2.37	26136
RZ63	$2542	359	11.1	131	139	74.9	3.09	2.41	25542
RZ66	$2304	357	39.0	137	121	49.5	10.5	2.24	26136
Bowie	$1895	282	11.1	92.2	145	24.1	9.90	1.91	25542
RZ64	$1560	248	33.4	108	65.6	32.2	8.66	1.69	22572
RZ68	$1753	228	5.57	66.8	67.4	68.1	20.4	2.10	22572
RZ69	$1466	191	0.00	18.6	106	48.9	17.3	2.61	26730
Average	*$2598*	*374*	*20.0*	*126*	*148*	*66.2*	*14.3*	*2.51*	*25790*
LSD 5% [2]	-	*238*	*34.0*	*145*	*82.4*	*51.2*	*23.8*	*1.39*	*4193*

Table 2. Length and diameter (L:D) ratios, and cull data from twelve pickling cucumber cultivars planted at LaRaCha Farms, Reese, Michigan. [1] Type of fruit skin: American (Am), or European (Eur). [2] Bushels/Acre after culls were determined by taking the percentage of culls from the Total Bushels/Acre from Table 1. [3] Means differing by more than this amount are significantly different at α=0.05, based on Fisher's LSD.

2016		L:D ratios				Cull%			Bushels/Acre after culls[2]
Variety	Skin type[1]	3B	3A	2B	2A	Crooks	Nubs	Hollow	
RZ65	Am	4.62	3.13	3.40	3.09	12.8	2.31	1.18	557
RZ60	Am	2.79	2.89	3.19	3.43	16.6	0.60	0.00	446
RZ67	Eur	2.93	2.98	2.77	2.89	14.6	3.67	1.82	424
RZ61	Am	3.04	3.06	3.21	3.45	18.9	0.00	15.8	412
RZ62	Eur	2.87	2.99	3.04	3.41	13.9	3.62	0.00	410
Gershwin	Am	2.99	3.16	3.04	2.94	16.3	6.75	7.14	392
RZ66	Am	2.96	3.03	3.10	3.47	18.0	5.24	23.6	346
RZ63	Am	2.81	2.91	2.95	3.13	13.5	0.00	3.07	333
Bowie	Am	2.78	3.04	3.16	3.15	9.45	6.31	20.9	271
RZ64	Am	2.76	3.05	2.69	3.00	18.6	3.21	12.8	238
RZ68	Eur	1.32	2.91	3.00	3.17	7.15	1.09	1.09	197
RZ69	Eur	2.25	2.60	2.75	3.01	0.61	3.15	1.32	151
Average	-	*2.91*	*2.98*	*3.02*	*3.20*	*13.4*	*2.99*	*7.39*	*348*
LSD 5% [3]	-	-	-	-	-	*7.05*	*13.2*	*13.2*	*226*

Special thanks to George Pape, of Rijk Zwaan Seeds; The Bauer family; and Don Percy and Joel, from Hausbeck Pickle Company.

2016 Evaluation of Hybrid Bell Pepper Varieties for High Tunnel Production in Kansas

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Introduction

High tunnel (hoop house) production of vegetables has become quite common in Kansas. High tunnels protect crops from harsh environmental conditions that can lead to wind and storm damage. In addition, high tunnels provide an excellent system for hybrid bell pepper production in regards to planting date, soil temperature, crop height, etc. Therefore, this system protects the crop, lengthens the growing season, and therefore increasing economic impact for the grower (Carey et at, 2009).

Bell peppers in Kansas are a valuable commodity that is sold through farmers markets, CSA's, on-farm sales, wholesale markets and restaurant sales. Results from a grower survey conducted by the Kansas Rural Center in 2015, peppers are ranked 3rd in specialty crops grown in Kansas. As for growing in high tunnels, peppers are ranked the 5th most popular crop grown in the central United States (Knewton et at, 2010). Our goal of this study was to investigate the performance of ten hybrid bell pepper (green to red) varieties for fresh-market production in high tunnels.

We conducted a variety trial of bell peppers grown in a high tunnel to determine which cultivar is best suited for hoop house cultivation in the central United States. Ten commercially available varieties were tested and yields ranged from 7.2 to 12.2 lbs of total fruit per plant. The three varieties with the highest marketable fruit number per plant were 'Archimedes', 'Currier', and 'Karisma'. These varieties also had the highest marketable fruit weight per plant and had similar rankings. 'Archimedes' was not statistically different from 'Currier' and 'Karisma' (P<0.05) in all categories in the 2016 season.

Materials and Methods

The trial was conducted at the Olathe Horticulture Research and Extension Center located approximately 30 miles southwest of Kansas City. Transplants were grown in soilless potting media using 50-cell propagation trays. Seeds were sown on 29 February 2016 and transplanted to 50-cell trays on 14 March. Transplants were set on 27 April and the trial was centrally-located in one bay of a multi-bay high tunnel (96' x 200' Haygrove Multibay High Tunnel). The trial was planted into four rows with each row consisting of one replication. A randomized complete block design was utilized with four replications. The high tunnel trial contained six plants per plot and in-row spacing was 18", which is typical of commercial pepper production. Plastic mulch and drip irrigation were employed and the stake-and-weave method was utilized to trellis the plants vertically. Fertigation was carried out at a rate of 10 lbs nitrogen/acre per application on 29 April, 1 June and 30 June and 1 August. Potassium nitrate was used for the first and third fertigation events and calcium nitrate was used for the second and fourth fertigation. Harvesting was carried out from 22 June until 11 October. During the last harvest, all fruit larger than 5 cm were picked and seconds were counted and weighed separately. Fruit were graded for

marketability and fruit number and weight were recorded. Average fruit size and percent marketability were determined and are presented below. All data were analyzed using ANOVA (PlotIt, Scientific Programming Enterprises, Haslett, MI), and a mean separation test was carried out by using an F-protected least significant difference (LSD) test. A separate analysis was carried out for each individual observation and the results of the LSD test are shown where statistically significant treatment effects occurred.

Results and Discussion

Table 1. Marketable and total per plant fruit yield of green pepper varieties grown in a three-season high tunnel in Olathe, Kansas.

	Marketable				Total			
Variety	**Number**		**Wt (lbs)**		**Number**		**Wt (lbs)**	
Archimedes	41.8	c	12.2	c	47.5	b	13.3	ab
Currier	37.8	bc	11.0	bc	43.5	ab	12.7	ab
Karisma	37.5	bc	11.4	bc	43.7	ab	12.8	ab
Red Knight	36.4	bc	9.7	abc	49.8	b	12.4	ab
Declaration	33.5	abc	8.9	abc	46.6	b	11.3	ab
Alliance	33.3	abc	9.8	abc	46.8	b	13.5	b
Vanguard	33.0	ab	10.5	abc	45.3	ab	13.5	b
Intruder	32.2	ab	9.0	abc	39.3	a	10.5	ab
Galileo	27.5	a	8.0	ab	47.5	b	12.0	ab
Bayonet	26.9	a	7.2	a	47.9	b	11.0	ab
$LSD_{(0.05)}$	*8.7699*		*3.4747*		*6.3822*		*2.8698*	

Table 2. Mean pepper fruit size (lbs) and marketability of green pepper varieties grown in a three-season high tunnel in Olathe, Kansas.

	Average Fruit Size (lbs)				Percent Marketability			
Variety	**Marketable**		**Total**		**Number**		**Weight**	
Vanguard	0.32	b	0.30	b	78.0%	abc	73.0%	ab
Karisma	0.30	ab	0.30	ab	88.7%	c	85.9%	b
Currier	0.29	ab	0.29	ab	87.3%	bc	87.1%	b
Alliance	0.29	ab	0.29	ab	72.5%	ab	71.1%	ab
Archimedes	0.29	ab	0.28	ab	91.2%	c	87.6%	b
Galileo	0.28	ab	0.26	ab	64.0%	a	58.3%	a
Intruder	0.28	ab	0.27	ab	85.9%	bc	81.8%	b
Red Knight	0.27	a	0.25	ab	79.0%	abc	72.9%	ab
Declaration	0.26	a	0.24	ab	78.1%	abc	71.6%	ab
Bayonet	0.26	a	0.24	a	64.5%	a	58.0%	a
$LSD_{(0.05)}$	*0.0458*		*0.0607*		*15.90*		*17.57*	

In our trial, 'Archimedes' had the highest marketable fruit number at 41.8 and marketable yield at 12.2lb per plant. This variety also had the highest percentage marketability in number and weight at 91.2% and 87.6% respectively. As for marketable number, 'Currier', 'Karisma', 'Red Knight', 'Declaration' and 'Alliance' were statistically similar to 'Archimedes' ($P<0.05$). In particular, 'Currier' and 'Karisma' have had consistently higher results in our variety trials since 2013 by finishing in the top half in all categories (data not shown). As for marketable weight, 'Karisma' and 'Currier' finished second and third with 11.43lb and 11.07lb per plant respectively. 'Vanguard' had the largest average marketable fruit size at .32lb and largest average total fruit size at .30lb. This variety has been consistent since 2013 finishing as one of the top four varieties for average fruit size (data not shown).

A large portion (>80%) of the fruit quality problems seen in this trial were the result of blossom end rot (BER). Although the cull fruit were not graded specifically for this issue, the results seen in this study were most likely the result of a lower incidence of BER.

There were two large flushes during the season. An early flush on 22 July and a later flush on 21 September. There were two other peaks during the season, but they produced lower yield. During the early peak harvest on 22 July, 'Archimedes', 'Currier', 'Karisma' and 'Red Knight' produced the highest yields and on 21 September, 'Karisma', 'Archimedes', 'Currier' and 'Vanguard' produced the most fruit (data not shown). Market demand timing may determine which variety may be ideal for certain growers. If a grower is targeting an earlier season customer base, then 'Archimedes', 'Currier' and 'Karisma' may work best. However, if market demand is later in the season, then 'Karisma', 'Archimedes' and 'Currier' are ideal varieties.

Acknowledgements

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Seed Sources

Harris Moran - HM
Seedway – SW/SDW
Johnny's Selected Seeds – JS
Sygenta - SY/RG/ROG

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Evaluation of 11 Bell Pepper Cultivars In Southwest Michigan

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Objective:

To evaluate performance of 11 bell pepper cultivars for adaptability to Southwest Michigan growing conditions.

Summary:

Statistical differences were found for all traits evaluated. SV0964PB and RPP43215 had statistically similar total yield at 1834 and 1673 bushels/acre, respectively. SV0964PB, RPP43215, Aristotle and Turnpike had similar yield of number 1 fruit. Growers should consider SV0964PB and RPP43215 for part of their plantings, providing they are released for commercial production by the seed companies that developed them.

Methods:

Fertilizer: Prior to planting, potassium, sulfur and boron were broadcast at 100, 25 and 2 pounds per acre, respectively. After planting, nutrients were applied through the drip irrigation system using Nitro Plus (18N-5Ca-1.5Mg and a proprietary growth regulator) at 15 gallons/acre on 6/13, 6/20, 6/27, 7/5, 7/11 and 7/18 and Harvest More Urea Mate (5-10-27 plus minor nutrients) at 20#/acre on 7/25, 8/1, 8/8, 8/15, 8/22, 8/29, 9/5 and 9/12 for a total of 188# nitrogen and 150# potassium/acre.
Weed control: Weeds were controlled by black plastic on the beds. Between row weeds were suppressed with Gramoxone using a backpack sprayer.
Planting: Plants were started in the greenhouse 7 April and planted to the field 2 June. Plants were set on raised, black plastic mulched beds, 6" high, 22" wide at the top and 5.5-feet on center. Plants were set in double rows 14" between rows and 18" in the row (10560 plants/acre). The trial was planted and analyzed as a completely randomized design with 16 plants per plot and four replications. Plots were separated by four guard plants.
Plant care: Plots were irrigated as needed and insects and diseases controlled using standard commercial practices.
Harvest and data collection: Harvest was conducted 4, 17, 31 August and 13 and 27 September, 2016. Fruit was graded into Jumbo, Extra Large, Large, Medium, Number Two and Culls. Each category was counted, weighed and converted into bushels per acre. Average number one fruit weight was also determined.

Results:

The 2016 growing season was good for pepper production in Southwest Michigan. Planting was a week later than usual for this trial. Plant growth seemed slow early in the season and fruit set was later, that is why an additional pre-fruit set application of Nitro Plus was applied. The season turned out warmer allowing the plants to reach full size and mature nearly all the fruit.

Differences were noted for all traits measured (Table 1). SV0964PB and RPP43215 had statistically similar highest total yield at 1834 and 1673 bushels/acre, respectively. These two and Aristotle and Turnpike had statistically similar number one yield (total of jumbo, extra-large, large and medium fruit) at 1438, 1254, 1293 and 1241 bushels/acre, respectively. Eight entries had similar average high number one fruit weight with weights ranging from 191 to 200.8 grams/fruit. (Table 1).

Aristotle is a widely planted variety in Midwest bell pepper plantings. This trial indicates it is still among the top performers in several traits but growers should consider SV0964PB and RPP43215 for part of their plantings, providing they are released for commercial production by the seed companies that developed them. Pictures of the 11 entries appear in Figures 1 – 5.

Table 1. Yield in bushels/acre and size grades of 11 bell peppers grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Average number one fruit weight is in grams. Plant population was approximately 10,560 plants per acre.

Entry	Seed Source	Total Yield	Yield No. 1	Avg. No. 1 Fruit Wt.	Yield Jumbo	Yield Extra Lg.	Yield Large	Yield Medium	Yield No. 2	Yield Cull
SV0964PB	SM	**1834**	**1438**	**197.3**	**487**	**361**	375	**215**	161	**234**
RPP43215	SY/RG	**1673**	**1254**	**194.1**	281	**328**	389	**257**	**231**	**188**
Aristotle	SM	1584	**1293**	188.0	288	**311**	**439**	**254**	**187**	103
RPP43212	SY/RG	1532	1197	**191.0**	**381**	**304**	306	**205**	145	**191**
SVPB7468	SM	1529	1233	**193.7**	344	**300**	374	**214**	**168**	128
Turnpike	SM	1515	**1241**	**199.8**	356	245	**404**	**236**	152	122
Green Machine	SM	1496	1127	186.0	290	237	355	**245**	**223**	146
SVPB6988	SM	1481	1231	**199.1**	326	254	**425**	**227**	161	89
Bayonet	SY/RG	1477	1229	181.6	196	268	**491**	**236**	**161**	86
Bastille	SY/RG	1420	1155	**200.8**	**405**	253	321	176	**173**	92
XPP9006	SK	1336	1060	**196.7**	293	254	322	191	133	143
	Lsd .05	**212**	**203**	**10.6**	**108**	**69**	**93**	**74**	**70**	**54**

Seed Source: SY/RG = Syngenta/Rogers, SK = Sakata Seed, SM = Seminis
Jumbo = >240 gm, Extra Large = 200-240 gm, Large = 170-200 gm, Medium (Med.) = <170 gm.
Numbers in **bold** in the same column are not statistically different than the highest number.

Figure 1. Bell pepper entries in the 2016 SWMREC bell pepper trial. Front row (left to right): SVPB6988, 'Green Machine', SVPB7468, SV0964PB. Middle row (left to right): 'Turnpike', 'Aristotle', XPP9006, 'Bayonet'. Back row: 'Bastille', RPP43215, RPP43212.

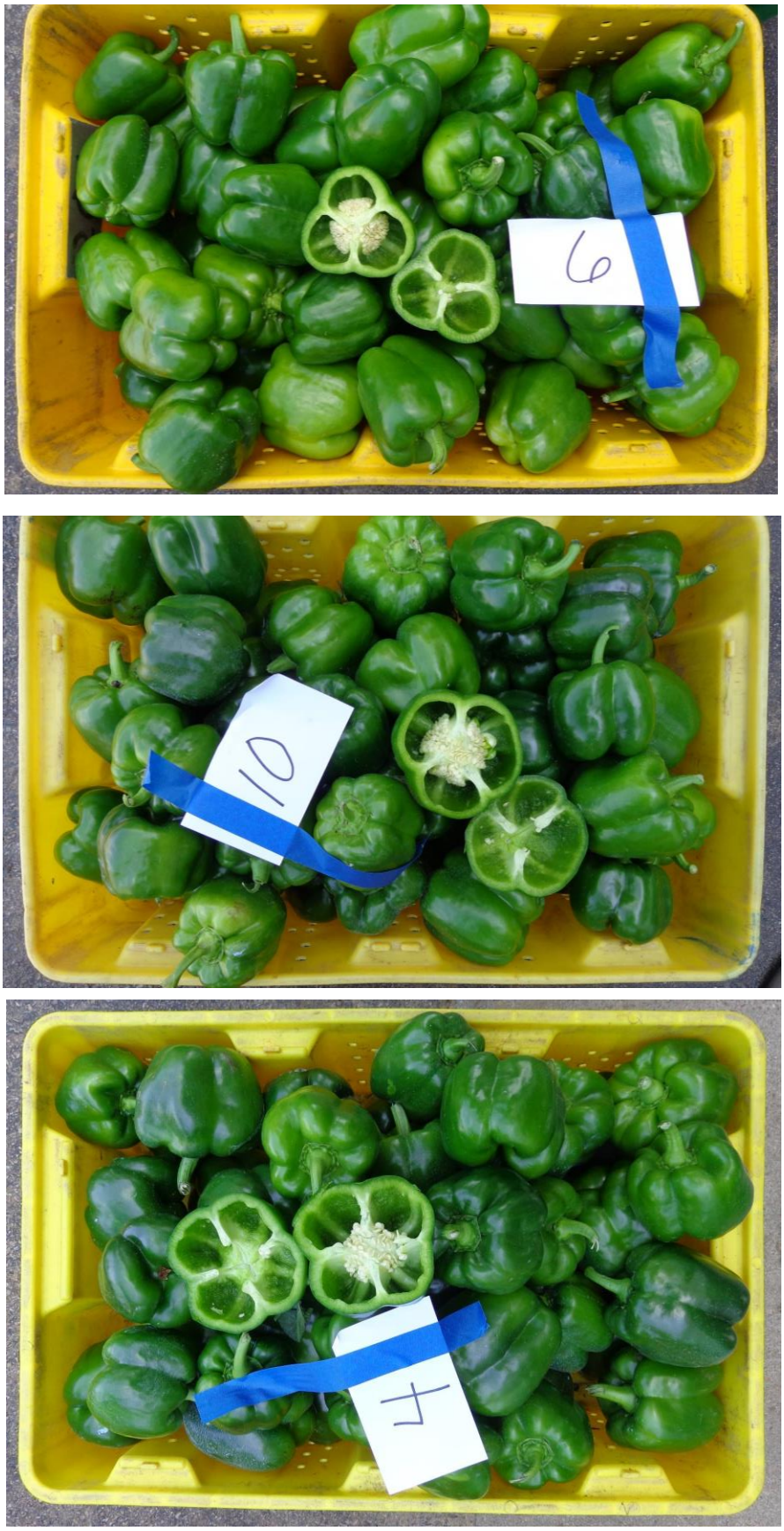

Figure 2. Number one fruit from the second harvest of (left to right) SV0964PB, RPP43215 and Aristotle.

Figure 3. Number one fruit from the second harvest of (left to right) RPP43212, SVPB7468 and 'Turnpike'.

Figure 4. Number one fruit from the second harvest of (left to right) 'Green Machine', SVPB6988, 'Bayonet'.

Figure 5. Number one fruit from the second harvest of (left to right) 'Bastille', XPP9006.

Evaluation of 15 Specialty Pepper Cultivars In Southwest Michigan

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Objective:

To evaluate performance of 15 specialty pepper cultivars for adaptability to Southwest Michigan growing conditions.

Summary:

All 15 entries yielded satisfactorily under Southwest Michigan conditions. The five harvests between 11 August and 5 October essentially picked all fruit on all entries. This was true even for the mini sweets that need to reach mature color prior to harvest and for the habaneros that are typically late maturing. Data was not subjected to statistical analysis due to differences in fruit type.

Methods:

Fertilizer: Prior to planting, potassium, sulfur and boron were broadcast at 100, 25 and 2 pounds per acre, respectively. After planting, nutrients were applied through the drip irrigation system using Nitro Plus (18N-5Ca-1.5Mg and a proprietary growth regulator) at 15 gallons/acre on 6/13, 6/20, 6/27, 7/5, 7/11 and 7/18 and Harvest More Urea Mate (5-10-27 plus minor nutrients) at 20#/acre on 7/25, 8/1, 8/8, 8/15, 8/22, 8/29, 9/5 and 9/12 for a total of 188# nitrogen and 150# potassium/acre.
Weed control: Weeds were controlled by black plastic on the beds. Between row weeds were suppressed with Gramoxone using a backpack sprayer.
Planting: Plants were started in the greenhouse 7 April and planted to the field 2 June. Plants were set on raised, black plastic mulched beds, 6" high, 22" wide at the top and 5.5-feet on center. Plants were set in double rows 14" between rows and 18" in the row (10560 plants/acre). The trial was planted as a completely randomized design with 16 plants per plot and four replications. Plots were separated by four guard plants.
Plant care: Plots were irrigated as needed and insects and diseases controlled using standard commercial practices.
Harvest and data collection: Harvest was conducted 11, 24 August and 7, 21 September and 5 October, 2016 and graded into number 1, number 2 and cull fruit. Each category was counted, weighed and converted into bushels per acre. Average number one fruit weight was also determined. Due to the wide variety of fruit types the data was subjected to statistical analysis.

Results:

The 2016 growing season was good for pepper production in Southwest Michigan. Planting was a week later than usual for this trial. Plant growth seemed slow early in the season and fruit set was later, that is why an additional pre-fruit set application of Nitro Plus was applied. The season turned out warmer allowing plants to reach full size and mature nearly all the fruit.

Yield data is shown in Table 1. Data was not subject to statistical analysis due to the large differences in fruit type. It also did not make sense to compare within fruit types since numbers were limited and two only had one entry. Nevertheless, results are of interest since it is an indication of how well entries performed under Southwest Michigan conditions in 2016. Pictures of the entries are shown in Figures 1 – 7.

All entries “fruited out” in 2016. That is, at the fifth and final harvest there were few if any fruit left for a sixth harvest. This is especially important for the three mini-sweets and the three habaneros. Mini sweets require enough time to change color before harvest and habaneros are generally late to mature. This was partly due to the warm season experienced in Southwest Michigan in 2016. However, in a more normal year these could be scheduled for a planting 10 to 14 days earlier than they were in 2016. This indicates these fruit types could be planted and fruited successfully in this area.

The habanero “Rey Pakal’ proved to be a mixed genotype with primarily red fruit but some plants yielded light orange fruit (Figure 6). This was true throughout all ‘Rey Pakal’ plots. BH 10344 had longer fruit than what is typical for a habanero so it might not be attractive to some producers and consumers. However, 10520 was fairly uniform in size and color and was quite attractive with a shiny red, almost porcelain appearance. It did have some slight shoulder cracking after a period of heavy rain. These cracks could potentially lead to post-harvest decay.

The three sweet bananas had the earliest yield and had quite a range in average number one fruit size, 45.6 grams/fruit for RPP28758 to 68.7 grams for ‘Goddess’. At 61.1 grams/fruit ‘Cavalcade’ was similar to ‘Goddess’ (Table 1).

Table 1. Yield in bushels/acre and number 1 fruit size of 15 specialty peppers grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Average number one fruit weight is in grams. Plant population was approximately 10,560 plants per acre.

Fruit Type and Entry	Seed Source	Total Yield	Yield No. 1	Avg. Weight No. 1 Fruit	Yield No. 2	Yield Cull
Sweet banana						
Goddess	UA	1404	1103	68.7	125	176
Cavalcade	SY/RG	1115	772	61.1	180	163
RPP28758	SY/RG	1076	681	45.6	166	229
Italian Roaster						
Escamillo	JSS	1366	916	105.1	257	193
Carmen	JSS	1148	803	82.4	162	183
Jalapeno						
Lexus	UA	1190	1008	37.1	90	92
Jedi	UA	698	464	30.7	100	134
Mini Sweet						
Red Sweetie	TS	825	671	38.0	71	82
Yellow Sweetie	TS	812	660	25.8	86	66
Orange Sweetie	TS	745	568	30.6	85	92
Habanero						
BH 10344	PAN	837	656	25.0	87	94
10520	PAN	733	565	19.2	62	105
Rey Pakal	PAN	630	504	21.4	78	48
Serrano						
Altiplano	UA	993	880	25.4	61	52
Poblano						
Masivo	UA	956	720	83.8	138	97

Seed Source: UA = Us Agriseeds, SY/RG = Syngenta/Rogers, Johnny's Selected Seeds, TS = Tozer Seeds, PAN = PanAmerican.

Figure 1. Specialty pepper entries in the 2016 SWMREC Specialty pepper trial. Front row (left to right): 'Goddess', 'Masivo', 'Altiplano', 'Lexus', 'Jedi', 'Cavalcade', 10520, 'Rey Pakal', BH 10344, 'Red Sweetie', 'Yellow Sweetie', 'Orange Sweetie', RPP28758, 'Escamillo', and 'Carmen'.

Figure 2. Number one fruit from the second harvest of 'Goddess' (left), 'Cavalcade' (middle) and RPP28758 (right).

Figure 3. Number one fruit from the second harvest of Escamillo (left) and Carmen F1 (right).

Figure 4. Number one fruit from the second harvest of 'Lexus' (left) and 'Jedi' (right).

Figure 5. Number one fruit from the second harvest of 'Red Sweetie' (left), 'Yellow Sweetie' (middle) and 'Orange Sweetie (right).

Figure 6. Number one fruit from the second harvest of 10520 (left), 'Rey Pakal' (middle) and BH 10344 (right).

Figure 7. Number one fruit from the second harvest of Masivo (left) and Altiplano (right).

Pumpkin Cultivar Performance Trial Grown in Southern Ohio 2016

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Objectives

To screen new pumpkin variety releases for their production performance under Southern Ohio growing conditions and to evaluate yield potential and fruit quality characteristics for the southern Ohio area.

Materials and Methods

This trial evaluated 70 pumpkin cultivars for their production suitability, performance and quality attributes under southern Ohio growing conditions. Cultivar selections were new releases along with industry standard varieties. Input was received from seed companies, growers, and industry personnel regarding variety selection and standard comparison. Seeds were direct seeded by hand to the field on June 21st. Rows were spaced 10 feet apart with seeds planted 3 feet apart in the row. The trial was located in southern Ohio, at the Ohio State University South Centers field research trials in Piketon, Ohio (lat. 39.07° N, long. 83.01° W, elevation 578 ft.). 100 pounds of N, P2O5 and K2O per acre were applied prior to planting. A standard commercial fungicide and insecticide program was implemented, following recommendations from the Midwest Vegetable Production Guide for Commercial Growers (ID-56). Weeds were controlled with a pre-emerge application of Strategy herbicide, cultivation and hand hoeing.

Results and Discussion

Overall plant and fruit quality was good in the 2016 season. Fruit were harvested on October 3rd.

Though seed companies have suggested plant spacing for particular varieties, i.e. bush, semi-bush, vining types, for this research trial a standard plant population of 1,452 plants per acre was followed and yields are based on these populations. Growers are advised to follow seed company plant population recommendations.

We wish to thank the Ohio Vegetable and Small Fruit Research and Development Program for their past support and seed companies for their in kind contributions to conduct this field research.

Table 1: Gourds

Variety	Pounds per Plant	Fruit per Acre	Pounds Per Acre	Average Fruit Weight (lbs.)	Seed Source
Crunchkin	6.31	15972.00	9165.02	0.54	HM
Munchkin	4.03	2904.00	5857.37	0.37	HM
Lil' Pump-Ke-Mon	1.59	16843.20	2314.49	0.80	RU
Small Warted Professional	9.51	32234.40	13811.42	0.43	HL
Jill Be Little	14.01	45012.00	20339.62	0.45	HL
Harrowsmith Select	20.85	46464.00	30280.01	0.65	JS
Daisy Gourd	11.21	55466.40	16279.82	0.29	JS
Gizmo Gourd	8.89	11035.20	12914.09	1.17	RU
Casperita	10.75	20037.60	15606.10	0.78	SW
Autumn Wings Small	7.09	18004.80	10288.87	0.57	RU
Galaxy of Stars	10.53	43269.60	15289.56	0.35	ST

Table 2: Jack O Lantern Pumpkins

Variety	Pounds per Plant	Fruit per Acre	Pounds per Acre	Average Fruit Weight (lbs.)	Seed Source
P17599	18.49	2904.00	26841.67	9.24	AC
P17606	8.12	1452.00	11796.05	8.12	AC
Early Giant	21.03	1161.60	30535.56	26.29	AC
Dependable	34.45	2323.20	50021.40	21.53	AC
Early King	13.25	1452.00	19241.90	13.25	AC
Bellatrix	28.52	2904.00	41413.94	14.26	EZ
Magic Lantern	40.46	4646.40	58753.73	12.65	HM
Magic Wand	22.61	2904.00	32826.82	11.30	HM
HMX 4680	13.32	2613.60	19343.54	7.40	HM
Ares	14.00	1452.00	20333.81	14.00	HM
Kratos	15.02	1742.40	21809.04	12.52	HM
Rhea	15.60	2323.20	22651.20	9.75	HM
Cronus	24.58	1452.00	35690.16	24.58	HM
Mustang	27.47	2323.20	39883.54	17.17	HL
Racer	31.85	5227.20	46243.30	8.85	JS
Cargo	30.66	2323.20	44512.51	19.16	JS
Champion	30.46	2323.20	44233.73	19.04	JS
JPN 61560	23.61	1742.40	34278.82	19.67	JS
Big Doris	23.24	2032.80	33738.67	16.60	RI
Eagle City Gold	28.01	4356.00	40664.71	9.34	RU
Hijinks	15.99	5227.20	23223.29	4.44	SK
Cracker Jack	19.79	2904.00	28732.18	9.89	SK
Earlipak	25.46	2613.60	36967.92	14.14	SK
Diablo	21.50	2613.60	31218.00	11.94	SK
Hulk	34.77	2613.60	50486.04	19.32	SK
Zeus	12.93	2032.80	18768.55	9.23	RI
Orange Rave	55.06	7260.00	79947.12	11.01	SW
Spartan	19.85	2323.20	28822.20	12.41	SW

Table 3: Pie Pumpkins

Variety	Pounds per Plant	Fruit per Acre	Pounds per Acre	Average Fruit Weight (lbs.)	Seed Source
Early Abundance	5.70	2613.60	8276.40	3.17	AC
Field Trip	24.39	9292.80	35408.47	3.81	HM
Mystic Plus	14.07	6098.40	20432.54	3.35	HM
Little Giant	8.30	5227.20	12057.41	2.31	HM
Sunlight	12.85	5227.20	18664.01	3.57	JS
Snowball	39.02	24103.20	56662.85	2.35	JS
RPX 5956	26.24	3775.20	38100.48	10.09	RU
Touch of Autumn	14.82	11325.60	21521.54	1.90	SW
Kandy Korn Plus	6.18	9873.60	8979.17	0.75	SW
Jack Sprat	12.10	8712.00	17569.20	1.78	SK
Fall Splendor	23.05	11906.40	33471.50	3.84	SK
Tiffany	20.68	9583.20	30021.55	3.13	SW
Apprentice	9.34	16843.20	13561.68	0.81	HM

Table 4: Specialty Pumpkins

Variety	Pounds per Plant	Fruit per Acre	Pounds per Acre	Average Fruit Weight (lbs.)	Seed Source
Warty Goblin	23.74	2904.00	34470.48	11.87	HM
New Moon	76.39	2904.00	110918.28	38.20	HL
Polar Bear	52.21	2323.20	75808.92	32.63	JS
Flat White Boer	46.51	5227.20	67529.62	12.92	RI
Fairytale	14.09	1161.60	20455.78	17.61	RI
Sirius Star	14.72	13648.80	21376.34	1.57	RU
One Too Many	18.28	1742.40	26545.46	15.24	RU
Red Warty Thing	18.60	2613.60	27004.30	10.33	RU
Blue Doll	50.11	4646.40	72765.53	15.66	RU
Cotton Candy	8.16	2323.20	11842.51	5.10	RU
Jarradale	27.24	4646.40	39546.67	8.51	SW
Speckled Hound	41.92	12777.60	60864.94	4.76	SW
Autumn Buckskin	58.44	6969.60	84857.78	12.18	SW
Grey Ghost	50.95	9292.80	73982.30	7.96	SW
Cinderella's Carriage	24.69	2613.60	35852.78	13.72	ST
Moonshine	23.88	6098.40	34676.66	5.69	ST
Jewel Box	38.68	3484.80	56166.26	16.12	SW
Peanut	33.05	3484.80	47994.41	13.77	SW

2016 Pumpkin Cultivar Evaluations in West Virginia

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Pumpkins (*Cucurbita sp.* L.) are a very popular fall ornamental crop in West Virginia. Each year, new commercial cultivars are released and growers must choose the appropriate cultivars for their respective markets. In 2016, we evaluated Jack-o-lantern pumpkins for adaptability to West Virginia.

Materials and Methods

Twenty-eight pumpkin cultivars were evaluated at the WVU Kearneysville Research Farm in the Eastern Panhandle of West Virginia (Figure 1).
The soil had a base pH of 7.2. Prior to planting 80 lbs. of N, P_2O_5 and K_2O were applied to the test plot area (≈0.7 acres). The pumpkin cultivars were seeded into 50-cell transplant trays and grown as transplants for 3 weeks before being hand-planted on June 28, 2016. We used biodegradable black plastic mulch for weed control. In addition, one cultivation was performed between beds to control weeds before vine closure. Each plot was 25 feet long with 7 feet between rows and 3 feet between plants resulting in approximately 2000 plants/acre. This was a relatively compact spacing, but given the soil quality, it was determined that this would be an average spacing for all cultivars. Standard pest management practices were employed including powdery mildew prevention. The experimental design was a randomized complete block design with 4 replications per cultivar. Marketable fruit were harvested on October 4-14, 2016 and sorted into marketable and nonmarketable before weighing and measuring quality variables such as color and ribbing.

Results and Discussion

Figure 1. Twenty-eight pumpkin cultivars were evaluated at the West Virginia University Kearneysville Farm in 2016.

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Table 1. Total marketable yield and fruit per acre for selected pumpkin cultivars in West Virginia- 2016.

Cultivar	Mkt (%)	Marketable pumpkins/acre (No.)	Avg. Wt. (lbs.)	Wt./acre (tons)
Ares	87.5	2963	17.9	4.3
Bayhorse Gold	92.4	2889	14.8	3.6
Bellatrix	96.0	3778	16.3	4.0
Camaro	85.8	3629	17.8	4.3
Capt. Jack	86.7	844	21.6	5.2
Cargo	100.0	3778	12.2	3.0
Challenger	100.0	2222	18.1	4.4
Champion	97.3	2667	20.0	4.8
Cronus	95.0	1259	18.8	4.5
Eagle City Gold	97.7	3185	12.3	3.0
Earlipak	55.0	815	15.4	2.8
Early King	96.8	2296	20.7	5.0
El Capitan	96.7	2222	13.7	3.3
El Toro	93.1	2148	17.4	4.2
Gladiator	86.5	2740	13.3	3.2
Gold Challenger	100.0	2741	15.7	3.8
Hannibal	98.2	4074	15.9	3.9
Honky Tonk	100.0	4578	12.4	3.0
Hulk	97.9	3481	22.0	5.3
Kratos	100.0	2296	16.7	4.1
Magic Lantern	98.1	3926	14.0	3.4
Magic Wand	100.0	3654	13.1	3.2
Mrs. Wrinkles	98.0	3556	14.6	3.5
Orange Rave	98.1	3778	12.2	3.0
Rhea	100.0	2222	15.2	3.7
Solid Gold	92.0	1852	16.6	4.1
Spartan	97.3	2741	17.2	4.2
Zeus	96.8	2296	13.0	3.2
Significance$_{(0.05)}$:		*137.6*	*0.3*	*0.2*

Average weight ranged from 12-22lbs (Table 1). The spacing used in this study probably reduced average fruit weight, however all of the varieties were equally spaced and relative differences in weight should be consistent across all of the varieties

evaluated. Within the range of 12-15lbs., cultivars such as 'Orange Rave', 'Honky Tonk', 'Mrs. Wrinkles', and Magic Wand' had significantly greater yields/acre. These cultivars had a dark orange color with excellent ribbing on the fruit which made the pumpkins particularly attractive to customers based on informal test marketing at the WVU Student Farm (Table 2).

For fruit weight >15lbs., 'Ares' 'Bellatrix', 'Camaro' 'Hulk' 'Hannibal', 'Bayhorse Gold' and 'Spartan' were excellent varieties with dark orange color and excellent fruit quality. 'Ares' and 'Hulk' were excellent tall pumpkins with good color and stem quality.

Table 2. Color and quality ratings of pumpkin cultivars evaluated in West Virginia,

Cultivar	**Days to harvest[z]**	**Color[y]**	**Ribbing[x]**	**Comments**
Cargo	100	DO	4.7	Intermediate resistance to PM[w]
Capt. Jack	105	MO	3.9	22-30 lbs. avg.; large handle
Early King	90	MO	3.2	21-26 lbs.; tall pumpkin with dark orange color
Eagle City Gold	100	MO	3.5	Medium-high yields
Gold Challenger	105	MO	4.0	Medium orange; good ribbing
Solid Gold	100	DO	3.6	17-22 lbs.
Hulk	100	DO	4.3	Large; tall pumpkin; 20-25 lbs.
Camaro	110	LO	2.3	Light orange with excellent PM[w] tolerance
Magic Lantern	100	DO	4.5	Excellent uniformity with PM tolerance
Mrs. Wrinkles	100	DO	5.0	Dark orange with deep ribbing
Challenger	110	MO	4.3	18-20 lbs.; good color and PM tolerance
Champion	115	DO	4.4	20 lbs.; poor handle quality
Gladiator	115	DO	4.4	Excellent PM tolerance with good color
Ares	115	DO	3.9	Excellent tall pumpkin with good color
Earlipak	100	MO	3.3	Poor yields
Hannibal	105	DO	4.5	16-20 lbs.; very uniform; good ribbing
Honky Tonk	100	DO	4.6	Very good yields 10-12 lb. fruit; dark orange
Bellatrix	95	DO	4.2	Excellent yields 16-18 lbs.
Cronus	100	DO	4.9	Large pumpkin with good ribbing and dark color
El Toro	110	MO	3.7	17-25 lbs. pumpkin; medium orange
Bayhorse Gold	100	DO	4.2	15-16 lbs. pumpkin weight; good yields
Orange Rave	100	DO	3.7	Excellent color, yield and uniformity
Kratos	100	DO	4.1	Medium orange; thick handles
Rhea	100	DO	4.2	Dark orange pumpkin with good ribbing
Spartan	100	DO	4.7	17-20 lb. fruit; dark orange
Magic Wand	115	DO	4.5	12-15lb. pumpkins ; dark orange with good ribbing
El Capitan	100	MO	3.6	15-20 lb. fruit; medium orange
Zeus	110	DO	3.5	15-20 lb. fruit; dark orange
Significance $_{(0.05)}$			*0.1*	

[z]Days from seeding

[y]DO=Dark Orange; MO=Medium Orange; LO=Light Orange

[x] Ribbing: 1-5; 1=poor/no ribbing; 5=excellent ribbing

[w]PM=Powdery mildew

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In addition, I thank Farm Staff at the WVU Kearneysville Farm for assistance in planting and plot maintenance.

2016 Butternut Squash Cereal Rye Cover Crop Tillage and Fertility Trial

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A cover crop management trial in butternut squash was planted at the Forgotten Harvest Ore Creek Farm (9153 Major Rd, Fenton, MI 48430) in a Miami loam soil with a 0-2% grade. The objectives were to determine how yields following a cereal rye cover crop were affected by three tillage systems and three at-plant fertilizer treatments in a split-plot Randomized Complete Block Design with four replications. The main plot factor was tillage: including bareground disked rye, no-tilled rye mulch, and strip-tilled rye mulch. Main plots were 600 ft long x 30.5 ft wide. Each main plot was then split into three randomized 200 ft long fertilizer treatment subplots. The fertilizer treatments included a high rate controlled-release fertilizer CRF (67.76 lb per acre actual N as 14-5-25-10S-2Ca), low rate controlled-release fertilizer CRF (47.16 lb per acre actual N as 14-5-25-10S-2Ca), and a grower standard fertilizer GSF (59.69 lb per acre actual N as 24-3-18-6S urea-diammonium phosphate-potassium sulfate). There were a total of 36 plots. High and low rate controlled-release fertilizers were a proprietary polymer-coated blend, provided by ICL Fertilizers (622 Emerson Rd. Suite 500, St. Louis, MO 63141). No plots in the study were irrigated.

On 17 October 2015 cereal rye was drilled into the four-acre experimental area at a rate of 120 lbs/ac. On 26 May 2016 the entire area was sprayed with glyphosate (1qt/ac), and on 2 June all of the rye was rolled perpendicular to the direction it was planted with a roller-crimper (I & J Manufacturing, 5302 Amish Rd, Gap, PA 17527). Rye was at least three feet tall, and heading out. Bareground plots were created on 4 June by incorporating the rye residue with a chisel plow and disc, and strip-till plots were created on 8 June with a single-row Zone-Builder® Subsoiler (Unverferth Manufacturing Co, Inc. 601 Broad St, P.O. Box 357, Kalida, OH 45853). Butternut squash (Betternut cultivar) was seeded with a custom single-row Monosem vacuum planter in five pre-marked rows, six feet between rows and two feet in-row. Seeds were coated in the Farmore F1400 chemical treatment consisting of thiamethoxam, mefenoxam, fludioxonil, and azoxystrobin. The seeding unit was set up to simultaneously deposit granular fertilizer in two bands five inches to either side of the seed row, and five inches below it. On 10, 11, and 13 June, each plot was planted while simultaneously delivering the calibrated rates of fertilizer. No planting depth adjustments were made between tillage treatments. On 14 June, we applied a tank mix of 0.5 oz Sandea, 3 pts Curbit, 1.33 pts Command per acre for weed control. No other pest or disease controls were applied for the remainder of the season. Pollination was provided by five bumble bee quads from Koppert Biological Supply (1502 Old US-23, Howell, MI 48843), and four nearby honey bee hives.

Soil inorganic nitrogen concentration was measured 30 days after planting (14 July dap), 60 dap (12 August) and 90 dap (12 September) by taking ten, eight-inch deep soil cores in the crop rows of each plot. On 6 and 7 Oct (108 and 109 dap), entire plants were

harvested in 40 ft. transects in the center section of the center rows in each plot. The numbers of squash plants were counted, and fruit were tallied and weighed separately as "clean" and "dirty". "Culls" were counted but not weighed. Weed pressure was assessed in each treatment plot on a 1-5 scale (1 = no weeds visible, and 5 = no crop plants visible).

Results

Planting and Establishment

The number of plants per acre was a factor that was tightly linked with yield. Rye residue, and fertilizer granule sizes interfered with planting and fertilizer application in all plots, respectively. In addition, the harder soil in no-till treatments resulted in a shallower seed depth, and more plant skips in the row. As a result, fewer plants germinated in no-till and bareground plots with heavy residue, and yield appeared to be suppressed (Table 1).

Yield response to tillage practices

The average plant populations and yields were highest in strip-tilled plots, followed by bareground plots, and no-till plots (Table 1). Compensatory fruit set occurred in no-till plots, where plant populations were lower, but fruit weights were similar across all treatments and yield did not increase proportionally to fruit set. The lower yields in the bareground and no-till treatments were probably due to higher weed pressure and slower germination/poor seeding depth, respectively. We also measured fruit set and yield from plasticulture squash outside the study area which were planted on different dates and were managed with a different fertility program than the study area. We observed more fruit per plant (3.12 fruit/plant), and higher overall yield (11.19 tons/acre), despite similar plant populations (4329.22 plants/acre) as our no-till plots.

Quality response to tillage practices

Despite lower yields, a higher percentage of fruit harvested from no-till plots were free of dirt (Table 1). Bareground plots had the least clean fruit. Plastic rows outside the study area had fewer clean fruit (7.76%) than in strip-tilled plots and no-till plots.

Yield response to fertilizer treatments

Yield was more sensitive to tillage than fertility in this trial. The yields were similar between the GSF and the high rate CRF (Table 1). Although not statistically significant at 0.05, these treatments appeared to yield higher than low-rate CRF. Due to factors that were likely unrelated to fertility treatments, there were fewer plants per acre, but more fruit per plant in GSF subplots, and the inverse was observed in the low rate CRF subplots.

Fruit weight response to fertilizer and tillage treatments

There was a significant interaction between fertility and tillage treatments on fruit weights (Figure 1). Low rate CRF treatments within strip-till plots had significantly lower fruit weights than in other tillage plots (as determined by a specific contrast). This may suggest that the level nitrogen (or other nutrient) became limiting in this tillage treatment as yield increased. However, this effect was not observed on overall tonnage.

Nitrogen availability

Soil N (nitrate and ammonium) concentrations in GSF subplots peaked 30 dap, but were higher than other treatments 90 dap. The high rate CRF subplots appeared to delay peak release of N until 60 dap, but had lower N 90 dap than the GSF subplots. The inorganic nitrogen decline across time in GSF and low rate CRF subplots is likely from crop uptake. However, GSF subplots had higher inorganic nitrogen peaks, and the greater nitrogen remaining in the soil at the last sample period could have been an effect of the lower plant population in GSF subplots.

Tillage may have had an effect on nitrogen mineralization. We would expect nitrogen availability to be higher in no-till plots, where plant population was lower and N uptake from the crop was likely also lower. However, nitrogen availability was similar to other tillage treatments. This suggests that nitrogen was not mineralized into a usable form as efficiently as in other plots. This "tie-up" is known to occur in no-till rye fields as a result of less field disturbance and cooler soils.

Weed pressure

Weed pressure was a complex of pigweed, nightshade, mustard, nutsedge, velvet leaf, marestail, potato, and jimson weed. The bareground plots had the highest weed pressure (averaging 3.33 on a 5-point scale), and strip-till and no-till plots had equal weed pressure (both averaging 1.92). Bareground plots had a higher weed pressure than the other treatments, presumably because of the lack of surface mulch. However, in some subplots, more tillage passes were performed to incorporate residue than in others, and weed pressure was highest in these subplots. This suggests that additional tillage passes may have encouraged weed germination in this trial.

Table 1. This table presents the summary of the main effects of the tillage and fertilizer treatments from Forgotten Harvest Ore Creek Farm, Fenton, MI. Means with the same letter within a column are not significantly different. [1] There was a significant interaction between fertility and tillage treatments on fruit weights, and this was analyzed separately in Figure 1. [2] Weed pressure was scored between 1 (no weeds visible) and 5 (no crop visible). [3] Means differing by more than this amount are significantly different at α=0.05, based on Fisher's LSD. [4] Means differing by more than this amount are significantly different at α=0.05, based on Tukey's HSD.

Treatments	Tons/ acre	Plants/ acre	Fruit/ acre	Fruit/ plant	Weight/ fruit (lb)[1]	% Clean fruit	Weeds[2]	Total inorganic N (ppm) 14 July	12 Aug	12 Sept
Tillage										
Strip-till	12.51 a	7498.03 a	10009.28 a	1.75 b	2.52	11.48 b	1.92 b	12.94 a	11.69 a	6.95 a
Bareground	9.70 b	5400.37 b	8116.92 b	1.99 a	2.36	2.25 c	3.33 a	11.64 a	12.74 a	7.52 a
No-till	8.72 b	4477.99 b	7248.10 b	2.29 a	2.39	19.64 a	1.92 b	14.54 a	13.40 a	7.76 a
LSD 5%[3]	*2.04*	*1671.07*	-	-	-	*7.24*	*0.85*	-	-	-
HSD 5%[4]	-	-	*1652.95*	*0.56*	-	-	-	*7.42*	*6.57*	*1.84*
Fertilizer										
Hi-rate CRF	10.88 a	5623.52 a	8509.67 a	2.05 a	2.55	13.29 a	2.42 a	10.86 a	13.76 a	6.32 a
GSF	10.39 a	5102.83 a	8247.84 a	2.24 a	2.45	8.09 a	2.67 a	15.51 a	14.39 a	9.14 b
Lo-rate CRF	9.65 a	6650.04 a	8616.79 a	1.74 a	2.28	11.99 a	2.08 a	12.75 a	9.68 a	6.76 a
LSD 5%[3]	-	-	-	-	-	-	-	-	-	*1.12*
HSD 5%[4]	*2.93*	*2314.7*	*2039.79*	*0.56*	-	*11.24*	*1.21*	*7.25*	*6.24*	-

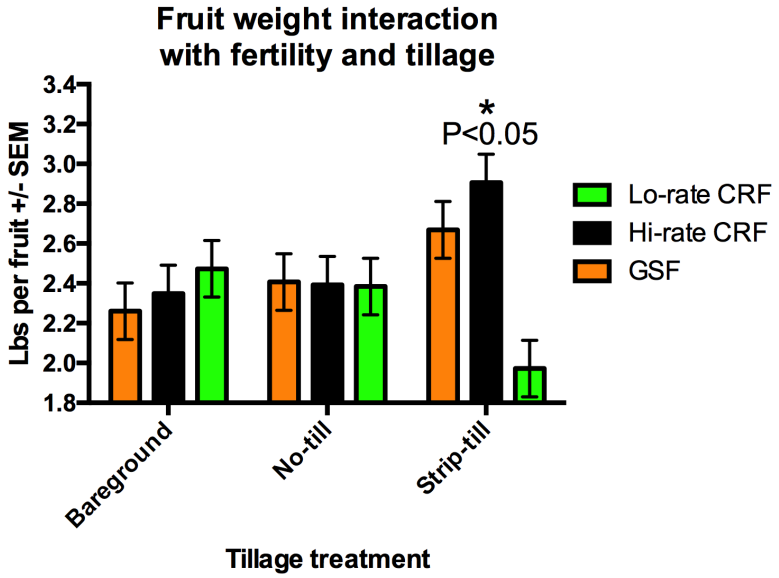

Figure 1. There was a significant interaction between fertility and tillage treatments on fruit weights. Lo-rate CRF treatments within strip-till plots had significantly lower fruit weights than in other tillage plots (as determined by a specific contrast). This suggests that N from low rate CRF became limiting as fruit weight increased in strip-till plots.

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Yield of 17 Summer Squash Varieties in Southwest Michigan

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Objective:

To evaluate commercial potential of 17 summer squash selections under southwest Michigan growing conditions.

Summary:

Statistical differences were found in the traits measured for the 14 zucchini entries. 'Payload', 'Spineless Beauty', 3043, SV6009YG and MG0001 were the leaders for all traits measured. Prior to selecting which varieties to plant, growers need to consider the virus complex in their production area and plan accordingly. 'Spineless Beauty' has no genetic tolerance for virus, but that was not a concern in this trial since no virus infection was detected during the production cycle.

Materials and Methods:

Fertilizer: Prior to planting 33-0-0, 0-0-60, 95% sulfur and Solubor were broadcast and incorporated at 100, 175, 28 and 13 pounds/acre, respectively. After planting, 42 additional pounds of nitrogen was applied through the drip system as 28% nitrogen beginning 13 June and ending 1 August.
Planting: All entries were direct seeded 26 May, 2016 on plastic mulched, 6" high raised beds into which a drip tape was inserted at the time of bed shaping. Rows were spaced 5.5' on center with an in row spacing of 2' providing 3960 plants/acre. The trial was planted as a completely randomized design with four replications and eight plants/replication. Two guard plants bordered each plot.
Plant Care: Plots were irrigated as needed and disease and insect pests controlled using commercially recommended cultural practices. Weeds were controlled using the black plastic and suppressed between rows with Gramoxone.
Harvest and data collection: Harvest was conducted thirteen times between 7 July and 8 August and fruit graded into number one small, medium, large and culls. The two yellow squash and the Mid-Eastern squash were excluded from the data set when it was subjected to statistical analysis.

Results and Discussion:

The 2016 growing season was good for summer squash production. There were periods of hot weather during flower and fruit set but they did not last long enough to cause significant yield reduction. Significant virus infection was also not detected in the trial during the harvest period.

Significant differences were noted in all traits measured. Total yield in half-bushels ranged from 2028 for 'Payload' to 741 for SB0027 (Table 1). Five other entries ('Spineless Beauty', 3043, SV0474YG, SV6009YG and MG0001) were statistically similar in total yield as 'Payload' (Table 1). 'Payload', 'Spineless Beauty', 3043, SV6009YG and MG0001 had similar yield across all traits measured. 'Easy Pick Gold II' was among the lower yielding entries at 943 half-bushels per acre. This is typical for a yellow zucchini. Pictures of the entries appear in Figures 1 – 6.

The three non-zucchini entries; 'Luciana', 'Goldprize' and SN0013 (Table 2), were not included in the statistical analysis of the zucchini entries and were not subjected to statistical analysis on their own. 'Luciana' is a Mid-Eastern variety with the typical shape and light green color while Goldprize and SN0013 are standard yellow summer squash (Figure 7).

Table 1. Yield in half-bushels of 14 zucchini selections at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Plant population was 3960 plants per acre.

Entry	Seed Source	Total Yield	Yield Small	Yield Medium	Yield Large	Yield Cull
Payload	RG/SY	**2028**	**789**	**539**	**602**	**97**
Spineless Beauty	RG/SY	**1918**	**751**	**547**	**550**	**70**
3043	BE	**1673**	**690**	**460**	**430**	**93**
SV0474YG	SM	**1669**	**773**	**549**	320	27
SV6009YG	SM	**1665**	**677**	**473**	**434**	**81**
MG0001	RG/SY	**1654**	**690**	**458**	**461**	**45**
SV9043YG	SM	1626	**755**	**471**	**368**	33
SV9951YG	SM	1447	**680**	**416**	320	**45**
Reward	HM	1277	**660**	**436**	159	21
SV0914YG	SM	1192	533	273	**356**	30
Esteem	HM	1188	640	218	296	33
MG0011	RG/SY	1053	416	330	266	**41**
Easy Pick Gold II	PAN	943	584	209	150	0
SB0027	RG/SY	741	410	153	152	26
	Lsd.05	**387**	**146**	**177**	**260**	**60**

Seed Source: RG/SY = Rogers/Syngenta, BE = Bejo, SM = Seminis, HM = Harris Moran, PAN = Pan American.
Small = <8 inches; medium = 8 – 10 inches; large = 10 – 12 inches.
Bold numbers in the same column are not statistically different from the highest number.

Table 2. Yield in half-bushels of three summer squash selections at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Plant population was 3960 plants per acre.

Entry and Fruit Type	Seed Source	Total Yield	Yield Small	Yield Medium	Yield Large	Yield Cull
Luciana Mid-East	UA	2023	702	593	624	104
Goldprize Yellow Squash	RG/SY	1529	785	450	272	22
SN0013 Yellow Squash	RG/SY	1388	719	448	206	15

Seed Source: RS = Rogers Seed Company, AC = Abbott and Cobb Seed Company. Small = <8 inches; medium = 8 – 10 inches; large = 10 – 12 inches.

Figure 1. Seventeen summer squash entries grown at the Southwest Michigan Research and Extension Center in 2016. Bottom row left to right; SV0914YG, SV9951YG, SV0474YG, SV6009YG. Second row left to right; 'Luciana', 'Easy Pick Gold II', 'Esteem', 'Reward', 'Spineless Beauty'. Third row left to right; SN0013, 'Payload', MG0001, 'Goldprize', MG0011. Top row; 3043, SB0027.

Figure 2. Payload (left), Spineless Beauty (middle) and 3043 (right) zucchini grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

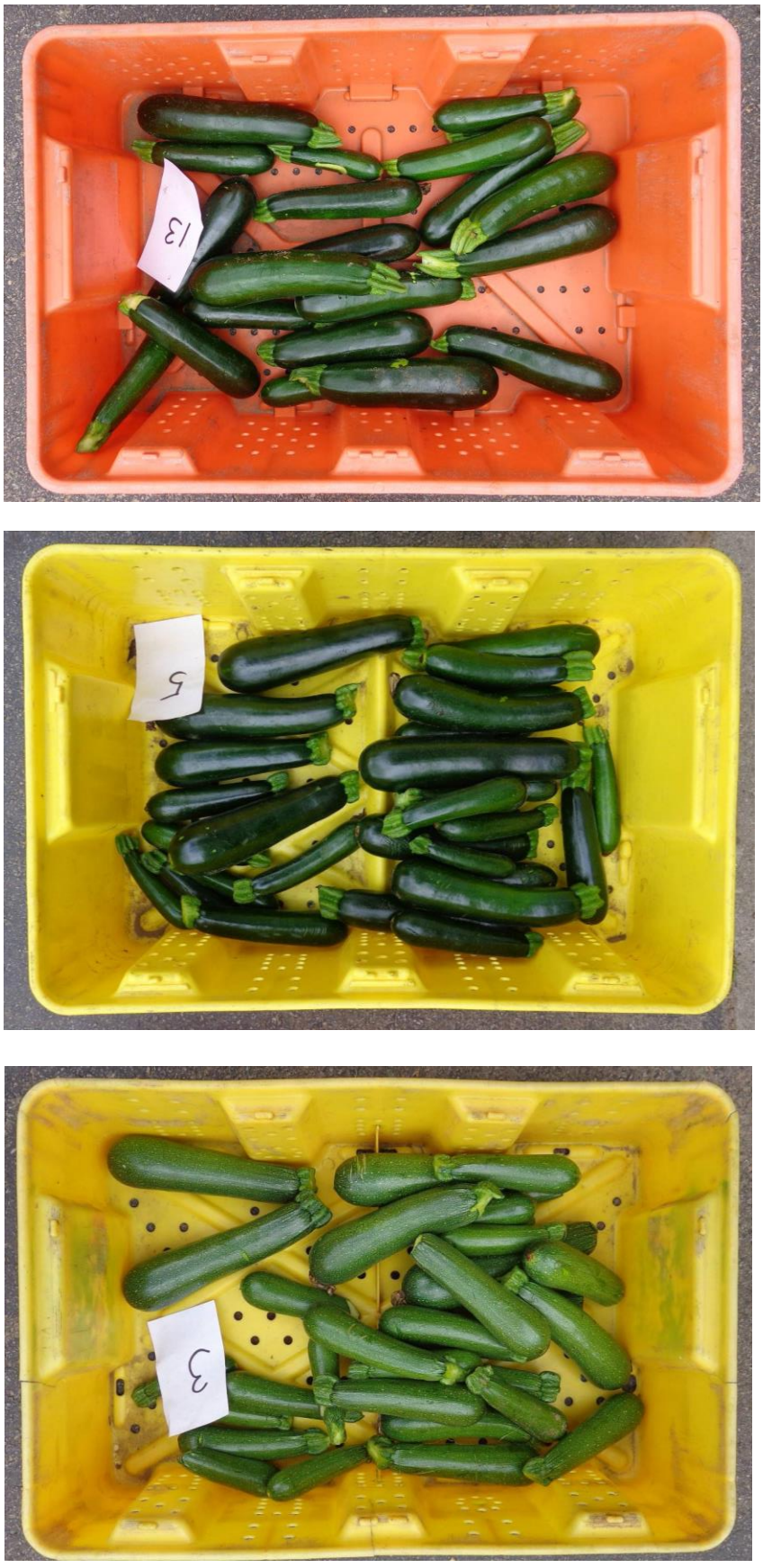

Figure 3. SV0474YG (left) SV009YG (middle) and MG0001 (right) zucchini grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Figure 4. SV9043YG (left) SV9951YG (middle) and Reward (right) zucchini grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Figure 5. SV0914YG (left) Esteem (middle) and MG0011 (right) zucchini grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Figure 6. Easy Pick Gold II (left) SB0027 MG0001 (right) zucchini grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Figure 7. Luciana (left) 3043 (middle) and Payload (right) Mid-Eastern and yellow squash grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Strawberry Variety Evaluation for High Tunnel Production in Southwest Indiana

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Strawberry production in Indiana primarily utilizes matted row systems, in which bare root strawberry plants are set in the spring, fruit is first harvested in the second year and plants are maintained for a few seasons. Strawberry production using an annual plasticulture system is popular in the southern states because it has a longer harvest period and produces strawberries with better quality. Growers in Indiana have expressed interest in annual plasticulture systems but short fall weather conditions pose a challenge for strawberry plants to reach the desirable size to be able to achieve the optimal yield the following spring. High tunnels that provide additional heat units and moderate frost protection are an effective tool for season extension. The protected cultural practices extend strawberry production season and improve fruit shelf life (Lamont 2009), making strawberries one of the most widely grown small fruit crops in high tunnels worldwide. The objective of this study is to evaluate the performance of strawberry varieties grown in annual plasticulture systems under high tunnel conditions in southwest Indiana.

Materials and Methods

The experiment was conducted in the 2015-2016 season in a 30 ft. wide and 96 ft. long high tunnel in Vincennes, IN. Ten strawberry cultivars were evaluated in the study. Among them, 'San Andreas', 'Albion' and 'Sweet Ann' are day-neutral cultivars. 'Florida Radiance', 'Benicia', 'Camarosa', 'Camino Real', 'Chandler', and 'Strawberry Festival' are June-bearing cultivars. Strawberry plugs were planted on 27 Aug. 2015 on raised beds. Randomized complete block design with three replications and 22 plants per variety per replication was used in the experiment. Strawberry plugs were planted in two rows on each bed. The distance between the two rows was 10 inches. Plants were spaced 14 inches within each row. 60 lb Nitrogen/acre using urea, 1 lb Boron/acre from Boron 14.3% and 2 lb Zinc/acre from Zinc sulfate were applied preplant. Fertigation was based on plant tissue test results. On average, 0.5 lb Nitrogen/acre/per day was applied starting in March by using potassium nitrate, calcium nitrate and urea-ammonium nitrate 28%. A total amount of 5 lb Magnesium/acre with Epson salt was applied in March and April. Pests were managed using recommendations from *Midwest Fruit Pest Management Guide 2016*. Yellow striped armyworms were controlled using Agree WG®. Torino®, Quintec®, and Rally® were used for controlling powdery mildew. Captan® and Scala® were sprayed for gray mold. 2,000 predatory mites (*Phytoseiulus persimilis*) were released in September, 2015. Oberon®, Acramite® and M-Pede® were sprayed to control two-spotted spider mites in the spring.

Row covers were applied at night when the temperature was expected to be lower than 32 °F and 50 °F in fall and spring, respectively, and taken off during days when the temperatures inside high tunnel were above 65 °F. Runners were pruned and recorded weekly. Harvest was conducted once a week during the fall and winter when there were ripe berries, and twice a week from the middle of April to the end of May. Five fruit per variety per replication were selected during peak harvest to measure fruit quality attributes, including total soluble solids (TSS), pH,

titratable acidity and flesh firmness. TSS was measured with a digital refractometer, pH and titratable acidity were measured using an 877 Titrino Plus system, and flesh firmness was measured with a handheld penetrometer.

Results and Discussion

The highest temperatures recorded in high tunnels were above 110 °F for about a week in early September, which caused 21.2% death of 'Benicia' plants, and 15.1% death of 'Sweet Ann' plants. No death of 'Camino Real', 'Festival' and 'Sweet Charlie' plants were observed (Table 1). Dead plants were replanted on 10 September. It should be noted that temperature inside high tunnels can reach a very high level when temperatures outside of high tunnels are above 90 °F. Caution must be taken when planting strawberries in early fall. The lowest temperature recorded under row covers in the winter was about 26 °F, at the time when the temperature outside of the high tunnel was about 4 °F. No crown damage was observed, while flower damage was noticed on varieties that had open blooms in the winter.

The top yielding variety in this trial was Radiance that produced 2.86 lb berries per plant, significantly higher than other varieties. 'San Andreas' (2.37 lb/plant), 'Chandler' (2.17 lb/plant) and 'Benicia' (2.08 lb/plant) also had the marketable yields above 2 lb/plant. 'Camarosa' had the lowest yield (1.42 lb/plant), similar to 'Sweet Ann' (1.62 lb/plant), 'Sweet Charlie' (1.62 lb/plant) and 'Albion' (1.70 lb/plant) (Table 2).

'Albion', 'San Andreas' and 'Sweet Ann' are day-neutral varieties. The harvest of 'Albion' started at the end of September, and the harvest of 'San Andreas' and 'Sweet Ann' started in the middle of October. Fall harvest of the three day-neutral varieties lasted until the end of December. 'Radiance' had the longest harvest period among the varieties although it was marketed as a June-bearing variety. First flower date of 'Radiance' was in middle October, which was similar to 'Sweet Charlie' and later than day-neutral varieties (Table 3). Harvest of 'Radiance' started in November with a few berries harvested during the coldest period in January and February. Primary harvest of 'Radiance' took off in middle April. Among the varieties that had berries ripe in the fall, 'Albion' had numerically higher yield (0.17 lb/plant), but it was not significantly different from the other varieties (Table 4).

Pruning runners in the fall is necessary to ensure plants direct energies to crown development. The variety that produced the most runners was 'Festival'. 'Albion' and 'Camarosa' had the fewest runners (Table 5).

Peak strawberry harvest started in middle April and lasted until the end of May for most of the varieties (Figure 1). 'Sweet Charlie' and 'Benicia' started to harvest in early April, about 10 days earlier than most of the other varieties. 'Sweet Charlie' was primarily harvested in April with fewer berries harvested in May compared with other varieties. Peak harvests of 'Chandler' and 'Camarosa' started in the end of April, about 10 days later than most of the other varieties. Although a few of 'Sweet Ann' were harvested in fall, the peak harvest season of 'Sweet Ann' did not start until the end of April (Figure 1).

Average fruit weight varied significantly among varieties. 'Sweet Ann' had the largest berries, followed by 'Albion' and 'Radiance'. 'Chandler', 'Camarosa' and 'Sweet Charlie' had the smallest berries that weighed significantly less than other varieties. The majority of the varieties

maintained a relatively even berry size throughout the season, but remarkable berry size reduction was observed on 'Benicia' (data not shown). At the peak harvest, 'Festival' and 'Sweet Charlie' had the highest total soluble solids (TSS). They also had higher pH than other varieties. 'San Andreas' had significantly higher titratable acidity. 'Benicia' and 'Camino Real' had the lowest TSS and they were also significantly lower in titratable acidity. Among the varieties, 'San Andreas', 'Festival' and 'Radiance' had firmer flesh than other varieties, while flesh firmness of 'Chandler' was significantly lower than other varieties (Table 6).

Major pests and diseases observed in the season were two-spotted spider mites, powdery mildew, and Botrytis gray mold. Powdery mildew severity rating of 'Benicia' was significantly lower than that of 'Festival' and 'Sweet Charlie' (Table 7). No significant difference in susceptibility to two-spotted spider mites was observed among the varieties (data not shown). Botrytis gray mold was the main cause of unmarketable fruit. 'Sweet Ann' had the most unmarketable fruit compared with other varieties, which accounted for 21.4% of the total yield. 'Festival' had the least amount of unmarketable fruit that accounted for 6.5% of its total yield (Table 2).

Results of the study indicate that growing strawberries in high tunnels in southwest Indiana can achieve a high yield and extend the strawberry season for two months in April and May. The study also shows that it is possible to harvest strawberries in the fall by planting day-neutral varieties in late summer. 'Albion' is the recommended variety for fall harvest. Overall, the recommended varieties for spring harvest based on the one year's study were 'Radiance' 'San Andreas' and 'Festival'. 'Radiance' and 'San Andreas' showed outstanding yields and good fruit quality. 'Festival' produced the sweetest berries in the variety trial and had a moderate yield. 'Radiance' was a superior variety in the current trial, however, it should be noted that 'Radiance' is highly susceptible to crown and root rots, a disease caused by *Phytophthora cactorum* (Whitaker, et al., 2012). Planting 'Radiance' should be avoided if there is a known history of crown and root rots in the soil. 'Benicia' had a high yield potential and was one of the varieties that flowered the earliest. However, young leaves of 'Benicia' showed crinkling and stunted growth, which eventually lead to plant decline during peak harvest season. These symptoms on 'Benicia' was also observed in a trial conducted in North Carolina (Gu, et al., 2017). 'Chandler' is the most widely grown strawberry variety in open field annual plasticulture systems. Although it has a high yield potential, it produced small and soft fruit under high tunnel conditions that largely increased the harvesting time. Comments on individual varieties are presented in Table 8.

Most high tunnels in the Midwest are dedicated to growing tomatoes. Tomato season in high tunnels lasts from late March to November with one or two tomato crops per year in southern Indiana. There is an emerging need for additional crops that will enhance farmers' rotation options to reduce the buildup of diseases and pests in high tunnels, as well as to increase markets for farmers. Annual strawberry production in high tunnels might be a rational option for high tunnel tomato growers as strawberries can be planted after a tomato crop in early September and followed up with another tomato crop in June. In this scenario, two tomato and one strawberry crops can be achieved in a two-year period. However, growers should be aware that tomatoes and strawberries are both susceptible to Verticillium wilt (caused by *Verticillium albo-atrum*). If Verticillium wilt is a concern, strawberries should not be rotated with tomatoes.

Strawberry is a high-value crop. Retail strawberry price can reach $5 per pound during Thanksgiving and Christmas markets. Fall strawberry production has a great economic potential.

However, considering the relatively low yields of day-neutral strawberries in the fall, using vertical systems to increase the number of plants grown in a high tunnel in the fall may be necessary to achieve a profitable margin. Harvests of field-grown strawberries in southern Indian start at the end of May and last to the middle of June. Prices normally range from $2-3.5/lb. Assuming locally produced, high-quality strawberries sell at $3.5/lb during April and early May, the highest yield variety, Radiance, could generate $10 per plant. Around 850-1,000 plants can be planted in a 30’ × 96’ high tunnel with the current planting spacing. A total of $8,500-10,000 could be generated. In addition, having strawberries for sale attracts customers to come and buy other produce. That benefit could outweigh the actual value of selling strawberries.

Growing strawberries is a labor intensive process that require 20-30 labor hours per week during peak harvest season. In addition, strawberries are susceptible to multiple disease and pest damages. Although diseases such as leaf scorch (caused by *Diplocarpon earlianum*) are less likely to occur under high tunnel conditions because of the exclusion of rain, two spotted spider mites can cause severe damage if preventative measures are not taken in a timely manner.

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Dr. Dan Egel assisted with disease management. Dr. Bruce Bordelon provided technical support. Southwest Purdue Agriculture Center staff Dennis Nowaskie and Angie Thompson assisted with managing the trial and harvesting strawberries. McNitt Growers (Carbondale, IL) donated the strawberry plugs.

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Table 1. Percentages of strawberry plants that died after temperatures in the high tunnel reached 110 °F for about a week in early September, 2016.

Variety	Percentages of dead plants	
Albion	1.5	b[1]
Benicia	21.2	a
Camarosa	10.6	ab
Camino Real	0	b
Chandler	4.5	ab
Festival	0	b
Radiance	4.5	ab
San Andreas	1.5	b
Sweet Ann	15.1	ab
Sweet Charlie	0	b

[1]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference tests at $P \leq 0.05$.

Table 2. Marketable and cull yields of strawberry varieties grown in a high tunnel in 2015-2016 season in southwest Indiana.

Variety	Marketable yield				Cull			
	Weight *lb/plant*		Fruit number *no./plant*		Weight *lb/plant*		Fruit number *no./plant*	
Albion	1.70	de[1]	31.36	de	0.19	ef	6.41	de
Benicia	2.08	bc	48.14	bc	0.33	bcd	12.14	b
Camarosa	1.42	e	40.82	cd	0.31	bcd	17.23	a
Camino Real	1.89	cd	39.86	cd	0.28	cde	8.59	cd
Chandler	2.17	bc	65.04	a	0.29	cde	13.14	b
Festival	1.88	cd	41.68	c	0.13	f	4.77	e
Radiance	2.86	a	53.36	b	0.39	b	10.73	bc
San Andreas	2.37	b	53.04	b	0.36	bc	12.18	b
Sweet Ann	1.62	de	27.18	e	0.44	a	12.54	b
Sweet Charlie	1.62	de	44.14	bc	0.26	de	11.68	bc

[1]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference tests at $P \leq 0.05$.

Table 3. First flower date of strawberry varieties grown in a high tunnel in 2015-2016 season in southwest Indiana.

Variety	**First flower date**[1]
Albion	Sep 20
Benicia	Jan 28
Camarosa	Feb 28
Camino Real	Feb 28
Chandler	Mar 6
Festival	Dec 15
Radiance	Oct 16
San Andreas	Sep 24
Sweet Ann	Oct 2
Sweet Charlie	Oct 13

[1.]First flower date was recorded when open blossoms were observed on all the three plots of each variety.

Table 4. Yield of fall harvested strawberry varieties grown in a high tunnel in 2015-2016 season in southwest Indiana.

Variety	**Fall Yield**[1] *lb/plant*	
Albion	0.17	a[2]
Radiance	0.09	a
San Andreas	0.08	a
Sweet Ann	0.10	a
Sweet Charlie	0.09	a

[1.]Strawberries were harvested in Oct. Nov. and Dec.
[2.]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference tests at $P \leq 0.05$.

Table 5. Runners developed by strawberry varieties grown in a high tunnel in fall 2015 in southwest Indiana.

Variety	**Runners developed in the fall**[1] *no./plant*	
Albion	5.23	e[2]
Benicia	2.68	f
Camarosa	5.27	e
Camino Real	5.73	de
Chandler	9.41	ab
Festival	10.64	a
Radiance	7.68	bcd
San Andreas	5.95	de
Sweet Ann	8.54	abc
Sweet Charlie	7.14	cde

[1.] Runners were pruned weekly till 21 Dec, 2015.

[2.] Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference tests at $P \leq 0.05$.

Table 6. Average fruit weight, total soluble solids, pH, titratable acidity and firmness of strawberries grown in a high tunnel condition in 2015-2016 season in southwest Indiana.

Variety	**Average fruit weight** *gram*		**Total soluble solids** *°Brix*		**pH**		**Titratable acidity** *% citric acid*		**Firmness** *gram-force*	
Albion	24.61	ab[1]	5.42	cde	3.77	c	0.58	bc	334.00	de
Benicia	19.86	d	4.80	e	3.81	bc	0.50	d	383.33	bcd
Camarosa	16.00	e	6.40	ab	3.92	abc	0.58	bc	346.00	de
Camino Real	21.64	cd	4.90	e	3.98	ab	0.48	d	370.00	cd
Chandler	15.23	e	6.05	bc	3.86	abc	0.63	ab	234.00	f
Festival	20.38	d	6.82	a	4.01	a	0.58	bc	430.67	ab
Radiance	24.35	bc	5.05	de	3.88	abc	0.52	cd	410.00	abc
San Andreas	20.41	d	5.72	bcd	3.75	c	0.67	a	455.33	a
Sweet Ann	27.43	a	5.77	bcd	3.86	abc	0.58	bc	398.67	bc
Sweet Charlie	16.67	e	6.92	a	4.01	a	0.55	cd	315.33	e

[1]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference tests at $P \leq 0.05$.

Table 7. Severity rating of powdery mildew of strawberries grown in a high tunnel in 2015-2016 season in southwest Indiana.

Variety	Disease severity[1]	
Albion	3.09	abc
Benicia	2.38	c
Camarosa	3.48	abc
Camino Real	3.05	abc
Chandler	2.95	bc
Festival	4.19	a
Radiance	2.62	bc
San Andreas	2.71	bc
Sweet Ann	2.86	bc
Sweet Charlie	3.62	ab

[1]Horsfall-barratt scale (0. 0% severity; 1. 0-3% severity; 2. 3-6% severity; 3. 6-12% severity; 4. 12-25% severity; 5. 25-50% severity; 6. 50-75% severity; 7. 75-88% severity; 8. 88-94% severity; 9. 94-97% severity; 10. 97-100% severity; 11. 100% severity) was used for assessing powdery mildew damage on 6 plants in each experimental plot. Ratings of the 6 plants were averaged for statistical analyses. Disease severity was rated on Oct. 28, 2015.

Table 8. Comments on strawberry varieties grown in a high tunnel in 2015-2016 season in southwest Indiana.

Variety	Comments
Albion	Suitable for commercial fall harvest in high tunnels, peak harvest in the spring start in middle April, large fruit size, total yield was moderate to low
Benicia	Peak harvest started in early April. High yield potential. Good for the early market. Relatively tolerant to powdery mildew. Plant decline in peak harvest
Camarosa	Peak harvest start in end April, low yield potential, small berries
Camino Real	Peak harvest start in middle April, moderate yield potential
Chandler	Peak harvest start in end April, high yield potential, small and soft berries
Festival	Peak harvest start in middle of April, moderate yield potential, high fruit quality, produce many runners, relatively more resistant to gray mold but more susceptible to powdery mildew
Radiance	Harvest start in the fall, very high yield potential, longest harvest season
San Andreas	Harvest start in the fall, peak harvest start in middle April, high yield potential
Sweet Ann	Harvest start in the fall, peak harvest start in end April, low yield potential, large berry size, relatively more susceptible to gray mold
Sweet Charlie	Peak harvest start in early April, low yield potential, good fruit quality but small berry size

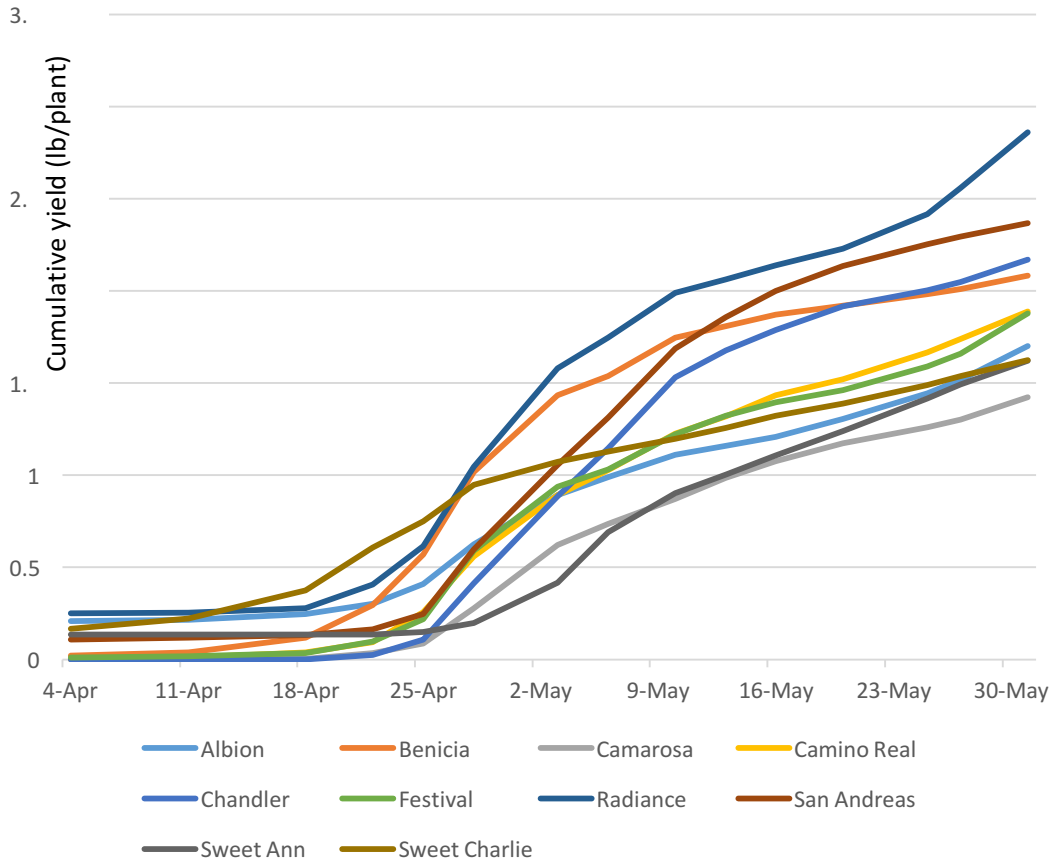

Figure 1. Yield in April and May of strawberry varieties grown in a high tunnel condition in 2015-2016 season in southwest Indiana.

Supersweet Corn Evaluations in Central Kentucky

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Locally produced sweet corn is a high-demand item at Kentucky retail markets. This trial was designed to evaluate some of the newest supersweet corn varieties.

Materials and Methods

Twenty-two supersweet corn varieties were planted by hand on 25 May in a Maury silt loam soil. Plots consisted of 20 ft long rows of each cultivar and were replicated four times in a randomized block design. Rows were spaced 33 inches apart. Roughly 200 seeds were hand-planted in each 20 ft row to assure a good stand. Seedlings were thinned to a nine-inch spacing.

Prior to planting, 80 lb of actual N, P and K per acre as 19-19-19 were applied to the soil and tilled in. Plants were fertigated with 36 lb of actual N per acre as calcium nitrate on 11 July.

Weeds were cultivated after planting, followed by application of Dual II Magnum herbicide on 14 June. Mustang Max and Baythroid were used for insect control. A low, three wire electric fence was set up around the plot at the beginning of harvest to exclude raccoons and coyotes.

Results and Discussion

Variety evaluation data can be found in Tables 1 through 3. The growing season was very rainy. There were 22 days having at least a tenth of an inch of rain from the planting date until first harvest. Browning/rotting on ear shanks showed up to a varying degree in most cultivars in the trial. This was diagnosed as a rot phase of Stewart's Wilt, a bacterial disease promoted by prolonged, wet conditions. Most of this was easily removed by taking off a little of the outer shuck covering. Yields for 18 of the 22 varieties were not significantly different from each other.

Munition was the best white variety and yielded significantly more ears than any other variety, Table 1. It also had good seedling vigor, tended to have some of the shorter ears, and had the highest height to the first harvestable ear. It was one of the standards for comparison in the trial.

Cabo, Battalion, AP 426, Anthem XR, and Obsession were the best bicolor varieties. AP 426 was notable in that it has a short 58-day maturity period, had one of the highest husk coverage ratings in the trial and produced an eight-inch-long ear. Husk coverage is important to reduce worm, sap beetle, and bird damage. Husk coverage was particularly poor this season in comparison to previous seasons. Tip fill was particularly good for all but two varieties. Battalion was one of the few with little to no shank decay. Obsession was a recommended variety used as a standard in the trial.

GSS 1170 was the highest yielding yellow variety, and also one with little to no shank decay, but also had the shortest ears. Eating quality for all of the varieties evaluated was excellent (Table 3). Battalion, GSS 1170, AP 426, Anthem XR, and the standard Obsession all had high sweetness ratings.

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Table 1. Plant characteristics and yields of sweet corn varieties, Lexington, KY, 2016.

Cultivar[1]	**Seed source**[2]	**Kernel Color**[3]	**Days to maturity**[4]	**Yield** ***dozen ears per acre***[5]	**Seedling vigor**[5] *1-5*	**Ease of ear harvest**[7] *1-5*	**Height to first harvested ear** ***in***
Munition (standard)	SY	w	78	3220 a	4.5	3	31.5
Cabo	SY	bc	78	2110 b	3.3	3.4	26.1
Battalion	SY	bc	77	2010 bc	3	3	24.3
GSS 1170	SY	y	78	2010 bc	3.6	3	26.5
AP 426	RU	bc	58	1980 bc	3.4	3.3	22.8
Cumberland	ST	bc	77	1900 bcd	4.3	3.1	20
Anthem XR	SW	bc	72	1850 bcde	4.9	3.5	21
Obsession (standard)	RU	bc	79	1830 bcde	3.9	3.5	23
Enchanted	RU	bc	78	1820 bcde	3.5	3.1	24
Super Surprise	RU	bc	74	1820 bcde	4.6	2.3	18.8
Prestige XR	SW	bc	77	1780 bcde	4.5	3.5	20
XtraTender 2171	JS	bc	71	1770 bcde	3.8	3.5	21.3
Nirvana	SW	bc	75	1700 bcde	3.4	4.4	18
Superb MXR	ST	bc	74	1680 bcde	5	3	18.3
Vision MXR	JS	y	75	1630 bcde	4.1	3.4	17.3
SS 3778	JS	y	76	1630 bcde	2.9	3.5	22.3
Honor XR	ST	bc	79	1620 bcde	4.3	3.4	24.8
SS 2742	JS	bc	75	1600 bcde	3.3	3.3	20.8
Eden	ST	w	76	1600 bcde	3.4	3.5	19
XTH 11274	ST	y	72	1490 cde	4.1	3.7	19.8
XtraTender 20173	JS	bc	73	1450 de	2.9	3.1	24.3
Gourmet Sweet 2171	ST	bc	72	1370 e	3.9	3.9	22.3

[1]All but Battalion, Obsession, Prestige, SS 3778 and Honor XR are augmented supersweet varieties.
[2]See appendix for seed company addresses.
[3]Kernel color: y = yellow; w = white; bc = bicolor.
[4]Days to maturity noted in seed catalogues.
[5]Numbers followed by the same letter are not significantly different (Duncan Multiple Range Test $P \leq 0.05$).
[6]Seedling vigor: 1 = poor growth, 5 = excellent growth.
[7]Harvest ease: 1 = difficult to remove ear from stalk; 5 = easy to remove.

Table 2. Ear characteristics of sweet corn varieties, Lexington, KY, 2016.

Cultivar	Husk coverage[1] *1-10*	Ear length *in*	Ear width *in*	Tip fill[2] *1-10*	Row straightness[3] *1-10*
Munition	6.5	7.5	1.8	9.8	5.3
Cabo	6.5	8.1	1.9	9.8	6.5
Battalion	5	7.7	1.9	10	4.8
GSS 1170	6	7.5	1.8	9.5	4.5
AP 426	8.3	8	1.9	9.5	5.3
Cumberland	1.3	8.5	1.9	10	5
Anthem XR	7.3	7.9	2	9.8	4.8
Obsession	7	8	2	9.8	5.8
Enchanted	5.8	8.2	1.9	10	4.8
Super Surprise	4	8.2	2	9.8	5
Prestige XR	5.5	8.1	1.8	10	4.8
XtraTender 2171	4.3	7.8	1.9	10	5.8
Nirvana	1.8	8.2	1.9	9.8	5
Superb MXR	7.5	7.7	2	9.5	4.3
Vision MXR	1.5	7.6	1.9	4.3	4
SS 3778	5.3	8.3	1.8	10	6.8
Honor XR	4.5	8	1.8	10	5.3
SS 2742	5.5	8.2	1.7	9.3	8
Eden	4.5	8.2	2	9.8	3.8
XTH 11274	3.5	8.2	1.9	6.8	3.8
XtraTender 20173	3.5	7.7	1.9	9.3	4.5
Gourmet Sweet 2171	2.3	7.9	1.9	10	6.5

[1]Husk coverage: 1 = corn ear protrudes from all husks, 10 = husks completely covered all ten ears.
[2]Tip fill: 1 = kernels not filling out ear tips, 10 = all ears filled to the tip with plump kernels.
[3]Row straightness along length of ears: 1 = poor, 10 = very straight.

Table 3. Eating quality characteristics of sweet corn, Lexington, KY, 2016.

Cultivar	Pericarp tenderness[1] *1-4*	Kernel tenderness[2] *1-4*	Sweetness[3] *1-4*	Comments
Munition	3.4	2.7	3.2	Attractive husk/ear; a few tassels on ears
Cabo	3.5	2.5	3.2	Attractive husk/ear; short flags; little stalk rot
Battalion	3.5	3	3.8	Attractive husk/ear; no stalk rot; short ears
GSS 1170	2.9	2.7	3.5	Husk not attractive; short ears; some tassels on ears; short flags
AP 426	3.4	2.9	3.6	Glossy ear; a few with butt-end blanking on ear; good corn taste
Cumberland	3.5	2.5	3.2	
Anthem XR	3.5	3.1	3.7	Attractive husk; some ears with split kernels and tassels
Obsession	3.5	3	3.8	Attractive husk/ear; short flags
Enchanted	3.5	2.5	3.2	Glossy ears; some with butt-end blanking and tassels
Super Surprise	3.3	2.9	3.6	Attractive husk/ear; long flags
Prestige XR	3.5	3	3.8	Attractive ear and dark green husk; several ears with tassels; little stalk rot
XtraTender 2171	3.5	2.5	3.2	Some ears with tassels
Nirvana	3.5	3	3.8	Some with split kernels; tender kernels
Superb MXR	3.5	3	3.8	Attractive ear, some ears with tassels; long flags
Vision MXR	3.6	3.2	3.7	Some kernel splitting; sap beetle damage; some ears with tassels; raccoon damage
SS 3778	3	3.1	3.5	Attractive husk/ear; long flags; a few slightly orange kernels; some tassels; good corn flavor
Honor XR	3.5	3	3.8	Attractive husk/ear; short-med. flags; pale husk not attractive; some ear tassels
SS 2742	3.5	2.5	3.2	Attractive ear; some ears with tassels; raccoon damage
Eden	3.5	2.5	3.2	Very tender kernels; raccoon damage
XTH 11274	3.4	3.2	3.6	Attractive ear; a few with butt-end blanking; raccoon damage
XtraTender 20173	3.5	2.5	3.2	Stalk rot problems
Gourmet Sweet 2171	3.5	2.5	3.2	Some ears with tassels and butt- end blanking

[1]Pericarp Tenderness: 1= tough; 4 = tender. Taste evaluations were performed by two evaluators on one ear from each replication; ear was microwaved on high setting for 2 minutes.
[2]Kernel tenderness: 1 = crisp; 4 = creamy and tender.
[3]Sweetness: 1 = starchy; 4 = very sweet.

Poly-Coated Urea Rate Influences Sweet Corn Yield

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Objective:

To determine if lower rates of poly-coated urea (PCU) applied prior to planting will provide the same yield and quality performance in sweet corn as split applications of 150 pounds of nitrogen per acre applied as regular urea.

Summary:

Differences were found between the five treatments in tons/acre, dozen ears/acre, ear diameter, above ground plant weight and final plant height. Three treatments (150# nitrogen/acre as standard urea and 150# and 125#/acre nitrogen as poly-coated urea) were similar in tons/acre and dozen ears/acre. Sweet corn producers could apply nitrogen at the 125#/acre rate as poly-coated urea and obtain similar yields as 150#/acre applied in split applications of standard urea. Using poly-coated urea would give producers the option of a onetime only application rather than split applications.

Methods:

Fertilizer treatments

Prior to planting, 175 pounds of 0-0-61, 25 pounds of sulfur, and two pounds of actual boron were broadcast over the entire trial area and worked into the soil. Nitrogen was supplied at the following rates as either standard urea (46-0-0) or ESN poly-coated urea (44-0-0):

1. 150# as ESN prior to planting.
2. 125# as ESN prior to planting.
3. 100# as ESN prior to planting.
4. 75# as ESN prior to planting.
5. 50# as urea prior to planting followed by a 50# side dress when plants were approximately 16” tall and again at 24” tall.

Applications prior to planting were worked into the soil by disking. Side dressing was done with a push style lawn fertilizer broadcast spreader followed by irrigation.

Planting

Soil type was Selfridge loamy sand with 0 to 3% slopes. Cabo (Syngenta Seed Company) sweet corn was planted 16 June, 2015 in rows 30” apart and 6” in the row (34,848 plants to the acre) using a Monosem vacuum seeder. Plots consisted of six

rows, 75-feet long surrounded by 10-foot alley ways between plots. The two best of the interior four rows were chosen as data rows. Plots were set up and analyzed as a completely randomized design with four replications.

Weed control
After planting, pre-emergent weeds were controlled on 17 June by applying Dual Magnum 7.6E and Aatrex 4L at a rate of 1.5 pints and 1 quart per acre, respectively.

Plant care
The planting was irrigated as needed with overhead sprinklers. No insecticides or fungicides were applied.

Harvest and data collection
Data on plant height was collected on 1, 14, 21 July and 2 August. At harvest on 25 or 29 August above ground plant weight (including the ear), marketable ear number from 50-foot of row and the weight, length and diameter of ears was determined.

Results:
Poly-coated urea (PCU) is a slow release, more uniform way to provide plants with nitrogen. Standard urea releases nitrogen quickly requiring sweet corn growers to side dress once or twice during the growing season. The slow release nature of PCU makes it possible to apply all the nitrogen prior to planting, freeing equipment and man hours for other activities during busier periods in the growing season. However, PCU is slightly lower in nitrogen analysis and more expensive. This trial was set up to determine if lower rates of a slow release product would provide similar yield and quality as urea.

Significant differences between treatments were found for several of the traits measured (Table 1). From an economic standpoint, the most significant traits are tons/acre and dozen/acre. Results from this trial found no difference between 150# nitrogen/acre as urea and 150# or 125# nitrogen /acre as PCU (Table 1) in these two traits. The 125# nitrogen as PCU rate was also similar to 150# nitrogen as urea in every other trait measured, whereas the 150# PCU rate differed slightly only in ear diameter. The 75# PCU rate gave the poorest performance differing from the leaders in tons/acre, dozen/acre, stalk weight and final stalk height. Visible differences in plant color and vigor where observed between the 75# and 100# rate of nitrogen and the other three treatments (Figures 1 and 2). Plants were more yellow with the lower two rates and the stands appeared thinner. Results from this trial indicate a PCU rate of 125# nitrogen/acre would provide the same performance as 150# nitrogen as PCU or urea.

Table 1. Growth and yield characteristics of Cabo sweet corn in response to five nitrogen treatments at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Plant spacing was 30 inches between rows and six inches in the row (34,848 plants/acre).

Nitrogen Amount	Tons/A	Dozen/ acre	Ear length	Ear dia.	Stalk weight	Ht. 1	Ht. 2	Ht. 3	Ht. 4	Ht. 5
150# PCU	**7.85**	**2316**	9.09	2.01	**1.43**	4.4	11.0	17.1	43.6	**75.9**
125# PCU	**7.04**	**2156**	9.09	**2.10**	**1.45**	4.2	11.6	18.2	45.1	**76.5**
100# PCU	6.29	**2149**	9.26	**2.09**	**1.26**	4.2	11.3	18.0	45.7	**74.3**
75# PCU	5.76	2091	8.95	**2.05**	1.02	3.9	9.8	16.0	40.8	69.5
150# Urea	**8.35**	**2316**	9.28	**2.12**	**1.81**	3.9	11.5	17.5	44.3	**73.6**
Lsd .05	**1.4**	**213**	**ns**	**0.09**	**0.58**	**ns**	**ns**	**ns**	**ns**	**6.3**

Numbers in bold are similar to the highest number for that trait.

Figure 1. ‘Cabo’ sweet corn fertilized with 75#/acre nitrogen as poly-coated urea (top) or 100#/acre nitrogen as poly-coated urea (bottom). Grown at the Southwest Michigan Research and Extension Center in Benton Harbor, Michigan in 2016.

Figure 2. ‘Cabo’ sweet corn fertilized with 125#/acre nitrogen as poly-coated urea (top) or 150#/acre nitrogen as poly-coated urea (middle) or 150#/acre nitrogen as split applications of standard urea (bottom). Grown at the Southwest Michigan Research and Extension Center in Benton Harbor, Michigan in 2016.

2016 Ohio Sweet Corn Evaluations

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Sweet Corn is an important crop in both the fresh market and shipping market in Huron and Sandusky Counties and throughout North Central Ohio, where a significant percentage of Ohio vegetables are grown. Many different varieties of sweet corn are grown by producers with fresh market roadside stands, and still others are grown for early, mid, and late season shipping and processing markets, meaning growers demand a diverse selection of sweet corn varieties and maturities. Growers have indicated this diversity should focus on SH2 varieties with different stages of maturity, and variance in other traits. Many new varieties are becoming available to meet these grower demands, and this study sought to determine which ones would perform acceptably in Northern Ohio, and which would have the desired traits growers are seeking. For this trial, 23 SH2 varieties were grown in 4 replicated plots at the Ohio State University's North Central Agricultural Research Station near Fremont, Ohio.

Materials and Methods

The purpose of this trial was to evaluate a significant number of newer varieties of sweet corn, helping seed companies determine which varieties would be suitable to continue breeding and developing for commercial seed sales, and helping growers determine which currently available varieties would be best suited for their specific market demands, including fresh market, shipping, and processing.

Growers and Seed Companies suggested varieties to be grown, with a strong preference for inclusion given to new and experimental varieties, for comparison alongside industry standard varieties. The evaluation used four replicated plots, grown under best management practices, to give growers a fair comparison of the different varieties grown on lake bed soils, within a normal Northern Ohio growing season. Plots were planted in 35 foot rows, with blocks of 4 rows per variety, replicated 4 times, with randomized variety location within each replication. After germination and stand counts, rows were trimmed to 30 feet and thinned to uniform population across varieties.

The SH2 trial was conducted on Colwood fine sandy loam soil on field CS at the North Central Agricultural Research Station. Best management practices were utilized prior to and during the trial. The field was deep ripped on October 7, 2015. On April 18, 2016, a dry fertilizer application of 100 lbs / acre of 11-52-0, 250 lbs / acre of 46-0-0, 400 lbs / acre of 0-0-60, and 10 lbs / acre of 10% granular Boron. Following application of dry fertilizer the field was plowed using a JD 2600 mold board plow. Secondary tillage including a disk harrow and a soil finisher was completed the following on April 19, 2016. The field was worked with a Danish tine field cultivator on May 18, 2016. The following day the field was fitted again with the Danish tine field cultivator with the addition of a soil firming packer. The plot area was also measured and flagged out on May 19, 2016. The plots were planted in 30 inch rows with an Almaco cone seeder atop John Deere 7000 planter on May 20, 2016 followed by application of 1.25 pts / acre of Dual Magnum and 6 oz. of Interlock. Stand counts were conducted on June 1. The trial was

cultivated on June 8, and 300 lbs / acre of 28% liquid nitrogen was side dressed into the plots also on June 8th. On June 13, the plots were thinned to a standard of approximately 8.5 inch plant spacing, and the rows trimmed to 25 feet, resulting in 35 plants per row, and a uniform simulated population of 24,400 plants per acre across all varieties and reps. The trial was hand weeded between plants on June 22. No fungicide applications were made to the trial. Five insecticide applications were made throughout the trial.

Insecticide applications were made as follows:

July 5	Artic 6.0 oz. / acre
July 12	Asana 9.6 oz. / acre
July 19	Coragen - 5 oz. / acre
July 26	Coragen 5.0 oz. / acre
August 1	Radiant 5.0 oz./ acre

The trial was threatened by drought from its inception so irrigation was implemented when soil moisture was insufficient for optimal plant growth. The following is a record of all irrigation and rainfall on the trial:

May	rainfall over crop	0.35 inches
June 20	irrigation	1.00 inch
June 29	irrigation	0.60 inch
June	rainfall, 5 events	2.40 inches
July 8	irrigation	1.10 inches
July	rainfall, 4 events	1.40 inches
July 20	irrigation	0.75 inch
Total rainfall plus irrigation from planting through harvest		7.60 inches.

Sweet corn plants were evaluated at harvest for the following characteristics, which are summarized in the tables: ease of harvesting ear (snap rating), ear height, stand population, harvested dozens per acres, and marketable dozens per acre. Immediately following harvest, 5 random marketable ears per variety were evaluated for flags, husk cover, tip fill, number of kernel rows/ear, kernel color, ear length, ear diameter, tenderness, sweetness, and overall flavor.

Results and Discussion

Results of the harvest and ear evaluation for each variety of sweet corn can be seen in the tables below, with total harvest data compiled and averaged from all 4 replicated plots. When interpreting yield data, it should be noted that with the thinning of the trial to a uniform population in early June, easy comparisons can be made on yield potential by analyzing harvest data. With a uniform 70 data plants present in each rep of each variety following thinning, and the resulting simulated population of 24,400 plants per acre, a “perfect” yield of one ear per plant would result in 84 plants per variety per rep, or 2033 dozen per acre.

In determining the ear evaluation scores, a team of 3 individuals, including the principal investigator and 2 members of the research station staff each made their individual rankings on the 5 ears for each characteristic, and the final reported value was the combined average from all 3 individual scores. This process held true for the tenderness, sweetness, and overall flavor scores as well, determined by raw taste testing of the 3 aforementioned individuals.

The growing conditions during this trial were nearly ideal except for the lack of rain. With irrigation, the trial flourished due to above average temperatures, low humidity and the absence of disease pressure. From planting to harvest, the trial was under minimal stress as demonstrated by the fact that many varieties were harvested at or before their predicted maturity dates. Four irrigation events totaling 3.45 inches were crucial to the vigor of the trial.

Acknowledgments

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M. Hofelich managed field operations. F. Thayer, R. Shaw and North Central Agricultural Research Station seasonal staff assisted with fieldwork and data collection. Ohio Agricultural Research & Development Center Department of Plant Pathology, conducted disease ratings and assisted with data analysis. K. Phillips assisted with data analysis.

Table 1. Variety characteristics, emergence, observed maturity, and individual ear yield. All varieties planted on April 20, 2016.

Variety #	Variety Name	Color	Listed Maturity	Harvest Date	Observed Maturity	Population data rows June 12	Harvested Ears	Marketable Ears
1	SV1446SD	Yellow	75	1-Aug	72	70	72	71
2	SV1580SC	White	80	3-Aug	74	70	77	74
3	EX08767143	Bi-color	81	3-Aug	74	70	75	73
4	08B2084	Bi-color	76	1-Aug	72	70	69	68
5	09B2437	Bi-color	76	1-Aug	72	70	69	68
6	Cumberland	Bi-color	77	29-July	69	70	73	72
7	HMX 4372	Bi-color	76	1-Aug	72	70	69	67
8	Cabo	Bi-color	78	1-Aug	72	70	72	70
9	BSS1075	Bi-color	N/A	3-Aug	74	70	61	60
10	CAPBF12-525	Bi-color	72	27-July	67	70	63	62
11	AP 426	Bi-color	79	3-Aug	74	70	74	70
12	Nirvana	Bi-color	75	27-July	67	70	70	67
13	CAPBF13-713i	Bi-color	78	29-July	69	70	70	66
14	CAPYF11-452	Yellow	74	27-July	67	70	66	63
15	Hero	Bi-color	70	27-July	67	70	65	63
16	Kickoff	Bi-color	70	27-July	67	70	58	56
17	Super Surprise	Bi-color	74	29-July	69	70	72	71
18	Xtra Tender 274A	Bi-color	74	27-July	67	70	61	60
19	Stellar XR	Bi-color	77	27-July	67	70	74	72
20	Honor XR	Bi-color	79	3-Aug	74	70	68	67
21	Prestige XR	Bi-color	77	29-July	69	70	73	72
22	Eden	White	76	27-July	67	70	63	61
23	Aces	Bi-color	79	3-Aug	74	70	65	64

Table 2. Harvest Data.

Variety #	Variety Name	Ear Height (in.)	Suckers	Snap	Harvested Dozen/ acre	Marketable Dozen/ acre
1	SV1446SD	25	5	2.5	2088	2059
2	SV1580SC	29	3	3.8	2233	2146
3	EX08767143	26	3	4.0	2175	2117
4	08B2084	28	5	4.3	2001	1972
5	09B2437	25.5	5	3.3	2001	1972
6	Cumberland	21.5	3	3.0	2117	2088
7	HMX 4372	24.5	5	3.5	2001	1943
8	Cabo	25	3	4.0	2088	2030
9	BSS1075	30	5	3.3	1769	1740
10	CAPBF12-525	18.5	5	3.3	1827	1798
11	AP 426	22	3	2.8	2146	2030
12	Nirvana	19	5	4.0	2030	1943
13	CAPBF13-713i	29	5	2.8	2030	1914
14	CAPYF11-452	19	5	2.5	1914	1827
15	Hero	22	5	2.9	1885	1827
16	Kickoff	23	5	3.7	1682	1624
17	Super Surprise	24	5	3.8	2088	2059
18	Xtra Tender 274A	20.5	5	4.0	1769	1740
19	Stellar XR	24	3	3.0	2146	2088
20	Honor XR	30	3	3.5	1972	1943
21	Prestige XR	25.5	5	3.1	2117	2088
22	Eden	17.5	5	3.8	1827	1769
23	Aces	26	1	4.2	1885	1856

Table 3. Ear Evaluation. All data is reported as the average rating of 5 ears from each variety.

Variety #	Variety Name	Husk Cover	Flags	Overall Husk	Shank	Tip Fill	Rows	Rowing	Color	Length (in)	Diameter (in)
1	SV1446SD	2	2	3.5	3.25	5	17.5	4.75	4.25	8.5	1.8
2	SV1580SC	1.5	3	3.75	2.5	5	18	5	4.25	8.2	1.9
3	EX08767143	2	4.25	4	3.25	5	17	4.75	4.5	8.3	1.9
4	08B2084	3	4	3.75	3.25	5	18	4.75	4.25	7.5	1.9
5	09B2437	2.75	4	4	2.5	4.75	16.5	3	4.5	8.3	1.8
6	Cumberland	2.25	4	4.25	2.25	4.75	16	3.75	4.25	8.5	1.8
7	HMX 4372	1.5	4	4	3.5	4.75	18	3	3	8.3	2
8	Cabo	2	4	4	3.25	4.75	17	4.5	4.25	8.1	1.9
9	BSS1075	1.75	3	3.5	2.75	5	18	4	4.75	8.1	1.9
10	CAPBF12-525	3	3.5	4	3	5	15	5	4.5	7.8	1.9
11	AP426	2.75	4	4	4	5	16	4.5	3.75	8.4	2
12	Nirvana	2	2.75	3.75	2.5	5	17	4.75	3.75	8.1	1.8
13	CAPBF13-713i	1.25	2.5	3.25	1.5	5	18	3.75	3.25	7.9	1.7
14	CAPYF11-452	3	3.75	4	3	5	16	3.75	3.75	7.6	1.8
15	Hero	3.5	4.25	4	2	5	16.5	4.75	3.75	7.9	1.8
16	Kickoff	2	4	4	2	5	17.5	3.75	3.5	8.4	1.9
17	Super Surprise	3	4.75	4	4.5	4.75	17	3.75	4.25	8	1.9
18	Xtra Tender 274A	2	3.25	4	3	4.5	18	3.5	4	8.4	2
19	Stellar XR	2	2.75	3.5	2	5	16	4	3	7.9	1.8
20	Honor XR	1.75	2	3	1.5	5	17	5	5	8.2	1.8
21	Prestige XR	2	3.5	3.5	2.75	5	16.5	4.75	4.5	7.9	1.7
22	Eden	2.5	3	3.5	1.25	5	16	3.75	5	7.8	1.8
23	Aces	2	4	4	3	4.75	16	5	4.75	8.4	1.8

Rating Scale for Table 3.

	Rating Scale		
Characteristic	**1**	**3**	**5**
Husk Cover (at tip)	Exposed	2 fingers of cover	4 fingers of cover
Flags	None	Noticeable/attractive	Many, long, attractive
Overall Husk	Poor	Good	Outstanding
Shank	Short	Average	Long
Tip Fill	2 in. blank	1 in. blank	Complete
Rows	number of rows around entire cob, rounded to the nearest whole number		
Rowing	Scrambled	Mainly straight	All straight
Color	Dull/flat	Average	Bright/attractive
Length	measured from tip to base of shank with husk removed		
Diameter	measured at center of cob with husk removed		

Table 4. SH2 Ear Evaluation. Estimated Eating Experience of Fresh Corn (Uncooked). All scores are reported as the average of 5 ears from each variety.

Variety #	Variety Name	Tenderness	Sweetness	Flavor
1	SV1446SD	4.0	4.75	4.25
2	SV1580SC	3.5	4.75	3.75
3	EX08767143	3.75	4.5	4.5
4	08B2084	3.5	3.75	3.5
5	09B2437	2.25	4.0	3.5
6	Cumberland	4.5	5.0	4.5
7	HMX 4372	4.75	4.75	4.75
8	Cabo	4.25	4.75	4.25
9	BSS1075	3.0	4.5	3.25
10	CAPBF12-525	5.0	4.0	4.25
11	AP 426	3.5	4.25	4.0
12	Nirvana	4.5	5.0	4.0
13	CAPBF13-713i	5.0	5.0	5.0
14	CAPYF11-452	4.5	4.0	4.0
15	Hero	4.5	3.5	3.5
16	Kickoff	4.0	4.0	4.0
17	Super Surprise	3.5	4.5	4.25
18	Xtra Tender 274A	3.5	4.0	3.0
19	Stellar XR	3.75	4.0	4.0
20	Honor XR	4.5	4.75	4.5
21	Prestige XR	3.5	4.75	4.5
22	Eden	5.0	4.75	4.75
23	Aces	4.75	5.0	5.0

Rating Scale for Table 4.

	Rating Scale		
Characteristic	**1**	**3**	**5**
Sweetness	Starchy/bland	Average	Very sweet/sugary
Tenderness	Tough	Average	Very Tender
Flavor	Poor	Good	Outstanding
BRIX (sugar content)	Refractometer readings were inconsistent due to equipment failure. Brix will not be published for this trial.		

Potassium Applications and Yellow Shoulder Disorder of Tomatoes in High Tunnels

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Experience suggests that tomatoes grown in unheated high tunnels can suffer significant loss in quality due to yellow shoulder disorder, particularly in susceptible varieties. The work reported here was conducted to determine whether incidence and severity of the disorder could be influenced by applying potassium fertilizers.

Materials and Methods

The trial was conducted in two 30 ft. X 48 ft. high tunnels on a Tracy sandy loam soil at the Pinney Purdue Ag Center in Wanatah, Indiana. High tunnel 1 was managed using organic practices and high tunnel 2 was managed conventionally. In high tunnel 1, 1,286 lb/A 13-0-0 fertilizer was applied and incorporated before planting. In high tunnel 2, 30 lb./A N from urea was applied before planting and 4.6 lb./A/wk N from UAN (1.5 gal/A/wk) was applied in irrigation for 9 weeks. Tomato varieties Red Deuce and Big Beef were seeded in 72-cell trays on March 31, 2015 and transplanted into high tunnels on May 7, 2015. Rows were 4 ft. apart and plants 21 inches apart in the row. Big Beef plants were pruned to two main stems and each stem was supported by a vertical string. Red Deuce plants were pruned up to but not including the branch just below the first flower cluster on the main stem. Stems of Red Deuce plants were supported by vertical strings–initially two stems per plant and then additional stems were supported as they got large enough to need support, for a total of 4 to 6 strings per plant. Plants were irrigated through two drip lines per row when tensiometers 6 inches deep exceeded 20 kPa soil water tension, resulting in 600-700 gallons per tunnel per week. Caterpillars were managed with one application of Dipel®, active ingredient *Bacillus thuringiensis*. Weeds were controlled by handweeding. Thermostatically-controlled roll-up sides were set to open when tunnel air temperature exceeded 80°F and close when tunnel air temperature dropped below 60°F. End walls were opened during the day and closed in the evening beginning at the end of May; at the beginning of July end walls were left open unless outside temperatures dropped below 50°F.

Each variety was treated as a separate experiment and each tunnel as a separate location. In each tunnel, two replications of four potassium treatments were established for each variety in a randomized complete block design. Treatment NONE had no potassium fertilizer. Treatment PRE had 300 lb./A K2O applied and incorporated before transplanting. This was the recommended maintenance amount based on a soil test of 120 ppm K. Treatment PRE-FERT had 126 lb. K2O applied in irrigation at 14 lb./week for 9 weeks, in addition to a preplant application as above. Treatment PRE-FERT-FOL was the same as PRE-FERT plus foliar application of K2O at 3.5 lb./A/week for 7 weeks. The potassium fertilizer was potassium sulfate in high tunnel 1 and potassium chloride in high tunnel 2. The experimental unit was 4 plants, 7 ft of row.

Recently mature tomato leaves were collected from each plot on July 15, dried, and sent to a commercial lab for determination of nutrient content.

Tomatoes were harvested from the center two plants in each plot July 27 – August 22, graded into marketable (USDA No. 1 or No. 2) and cull, counted and weighed. Several methods were used to assess yellow shoulder disorder. For a subset of fruit the percentage of the stem end of the fruit that was not red was estimated using the Horsfall-Barratt scale. When the disorder was present, severity on individual fruit was rated on a scale of 1 (slight) to 3 (severe). The number of fruit with severe yellow shoulder were counted and the percent of total fruit determined. Fruit that were culled due to yellow shoulder disorder were counted and percent of all culls determined.

Results and Discussion

Powdery mildew arrived early in the season and was not controlled.

Potassium treatments did not significantly influence marketable or total yield harvested through August 22 for either variety (Figure 1). Harvest could have continued for another month so it is not possible to know whether yield potential was influenced by potassium treatments.

Examples of yellow shoulder disorder are illustrated in Figure 2.

The percent of tomato fruit shoulder area that was not red was not affected by potassium treatment for Big Beef. For Red Deuce, the PRE treatment had more yellow on fruit shoulders than NONE or PRE-FERT, and PRE-FERT-FOL was intermediate (Table 1). High tunnels did not differ (data not shown).

The potassium content of leaf tissue was higher in high tunnel 1 than high tunnel 2 for Big Beef, but did not differ for Red Deuce (Table 2). For Big Beef, NONE and PRE treatments had lower leaf potassium than PRE-FERT-FOL, and PRE-FERT was intermediate. For Red Deuce, the PRE treatment had the highest leaf potassium content and other treatments did not differ from one another.

Although the potassium treatments did not influence yellow shoulder disorder in any consistent way, the amount of yellow shoulder disorder observed in individual treatment plots was negatively correlated with the leaf potassium content in that plot. Figure 3 shows that the severity of yellow shoulder disorder, the percent of cull fruit that had yellow shoulder disorder, and the percent of all fruit that had severe yellow shoulder disorder decreased as the leaf tissue potassium content increased.

From this preliminary work it isn’t possible to make recommendations for reducing yellow shoulder disorder with potassium applications. Plots with higher leaf potassium content tended to have less fruit with severe yellow shoulder disorder, but increasing the amount of potassium fertilizer applied did not significantly reduce the disorder. Additional work is needed.

Acknowledgments

J. Leuck and Pinney-Purdue Agricultural Center staff assisted with crop management. C. Brown assisted with harvest.

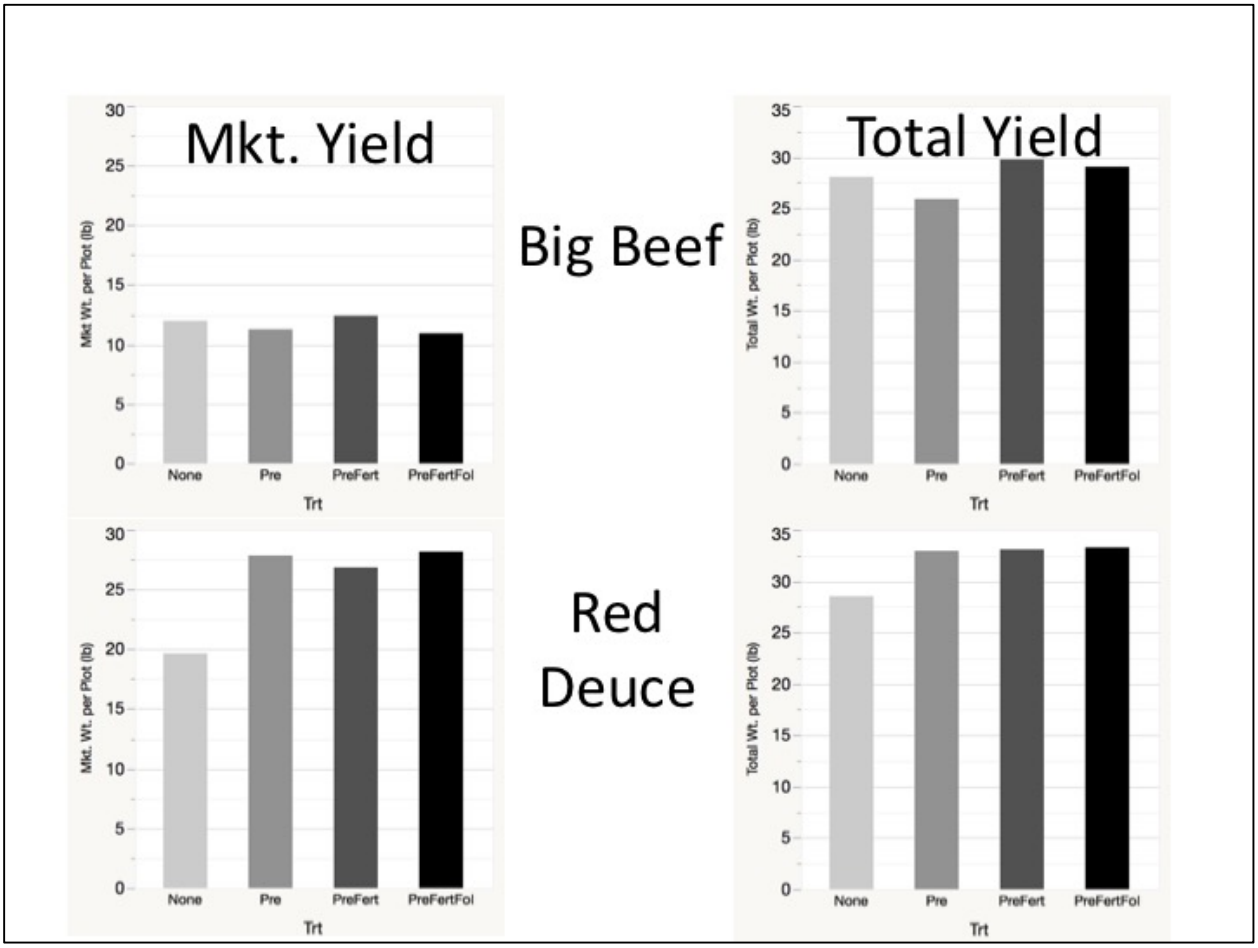

Figure 1. Marketable and total yield harvested from July 27 through August 22 for tomato varieties Big Beef and Red Deuce grown in high tunnels with various potassium fertilizer treatments, Wanatah, Indiana, 2015. None: no K fertilizer; PRE: 300 lb./A K2O preplant; PRE-FERT: PRE + 126 lb./A K2O applied in irrigation over 9 weeks; PRE-FERT-FOL: PRE-FERT + K2O at 3.5 lb./A/week for 7 weeks. Two plants were harvested per plot.

Figure 2. Examples of yellow shoulder disorder observed on tomato fruit.

Table 1. Percent of fruit shoulder area that is not red for tomato varieties Big Beef and Red Deuce grown with varying potassium fertilizer treatments in high tunnels, Wanatah, Indiana, 2015.[1]

Potassium Trt.	Big Beef		Red Deuce	
NONE	21.6		11.6	b
PRE	17.5		16.1	a
PRE-FERT	22.6		11.7	b
PRE-FERT-FOL	18.2		14.3	ab

[1]None: no K fertilizer; PRE: 300 lb./A K_2O preplant; PRE-FERT: PRE + 126 lb./A K_2O applied in irrigation over 9 weeks; PRE-FERT-FOL: PRE-FERT + K_2O at 3.5 lb./A/week for 7 weeks. Means within a column followed by the same letter do not differ at P<.05 based on Fisher's protected LSD.

Table 2. Leaf potassium content for tomato varieties Big Beef and Red Deuce grown in high tunnels with varying potassium fertilizer treatments, Wanatah, Indiana, 2015.[1]

High Tunnel	Big Beef		Red Deuce	
1	3.39	a	3.36	
2	2.53	b	2.59	
Potassium Trt				
NONE	2.77	b	2.82	b
PRE	2.83	b	3.36	a
PRE-FERT	3.04	ab	2.83	b
PRE-FERT-FOL	3.21	a	2.89	b

[1]None: no K fertilizer; PRE: 300 lb./A K_2O preplant; PRE-FERT: PRE + 126 lb./A K_2O applied in irrigation over 9 weeks; PRE-FERT-FOL: PRE-FERT + K_2O at 3.5 lb./A/week for 7 weeks. Means within a column followed by the same letter do not differ at P<.05 based on Fisher's protected LSD.

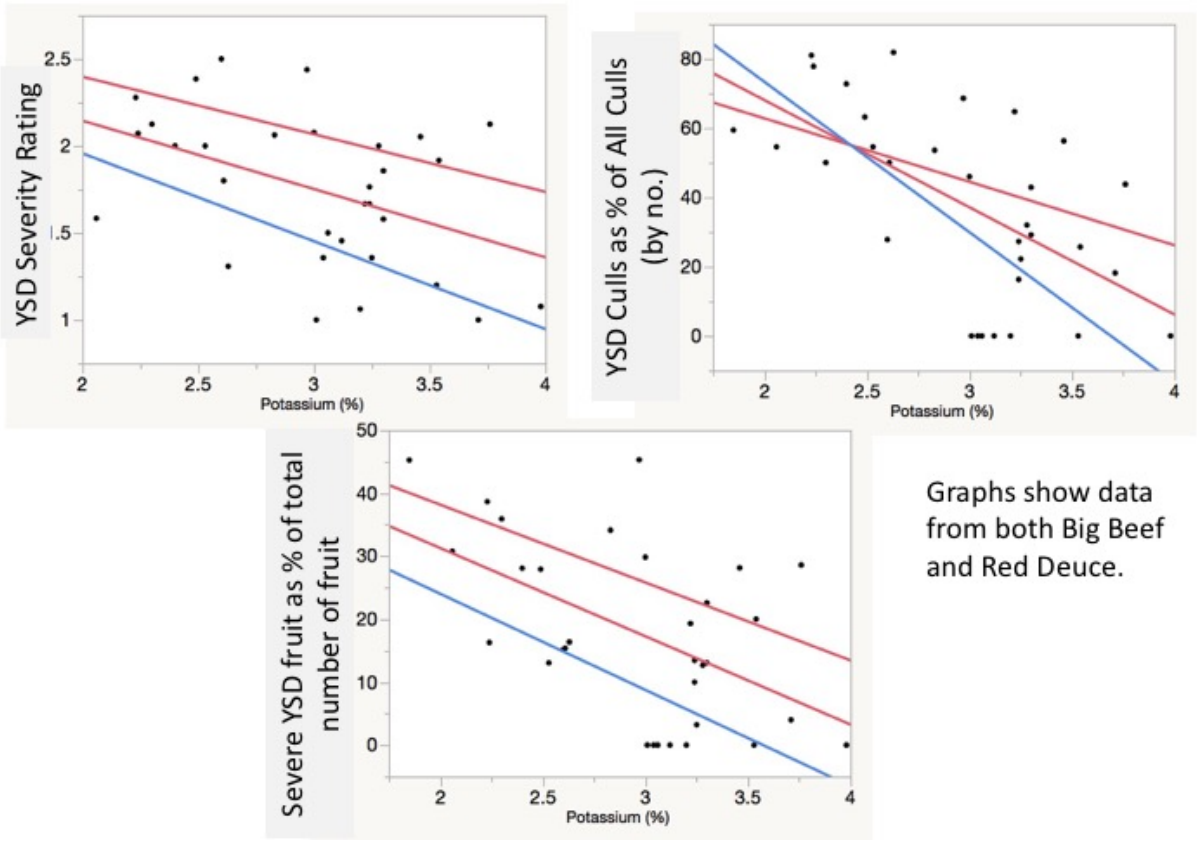

Figure 3. Tomato yellow shoulder disorder (YSD) severity, percent of culls due to YSD, and percent of all fruit with YSD versus tomato leaf potassium content (percent dry weight). Severity rating for fruit that showed the disorder ranged from 1 (slight) to 3 (severe). Each point represents one experimental unit. Graphs show data from Big Beef and Red Deuce and both high tunnels. The lines represent linear fits for Big Beef only (red, top line), Red Deuce only (blue, bottom line) and both varieties (red, middle line). P<.05 for all regressions. The trial was conducted in 2015 in Wanatah, Indiana.

2016 Evaluation of Determinate Tomato Varieties for High Tunnel Production in Kansas

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High tunnel (hoop house) production of vegetables has become quite common in Kansas. The high tunnels protect crops from Kansas harsh environmental conditions such as wind and storm damage. In addition to protection, determinate tomato crop requirements (planting date, soil temperature, crop height, etc), high tunnels provide an excellent system for tomato production. Therefore, this system protects the crop, lengthens the growing season, and therefore increasing economic impact for the grower (Carey et at, 2009).

We conducted a variety trial of determinate tomatoes grown in a high tunnel to determine which cultivar is best suited for hoop house cultivation in the Great Plains. Ten commercially available varieties were tested and yields ranged from 15.0 to 21.6 lbs of total fruit per plant. The three varieties with the highest marketable fruit weight per plant in order from highest number were 'Primo Red', 'Red Morning', and 'Red Deuce'. 'Red Deuce' had the largest marketable fruit size this season as well as in 2014 and 2015. 'Primo Red' had the highest percentage marketability by fruit number and weight this season as well as in our other similar variety trials in 2013, 2014 and 2015.

Introduction

Fresh-market tomatoes in Kansas are a valuable crop that is sold through farmers markets, CSA's, on-farm sales, wholesale markets and restaurant sales. Results from a survey conducted by the Kansas Rural Center in 2015 indicated that tomatoes are the most commonly-grown crops in high tunnels in Kansas. Similarly, tomatoes are the most popular crop grown in the central United States (Knewton et at, 2010).

In four-season high tunnels, indeterminates are often used in addition to determinate and heirloom varieties. However, in three season high tunnels, a vertical trellis system typically cannot be supported by the tunnel frame and planting dates are only slightly earlier than traditional field plantings. This offers a unique situation where determinates and/or semi-determinates grown in raised-bed plasticulture under stake-and-weave management are more practical than indeterminates and/or heirloom varieties. The goal of our study was to investigate the performance of ten determinate hybrid varieties for fresh-market production in a three-season high tunnel.

Materials and Methods

The trial was conducted at the Olathe Horticulture Research and Extension Center located approximately 30 miles southwest of Kansas City. Transplants were grown in soilless potting media using 50-cell propagation trays. Seeds were sown on 29 February 2016 and transplanted to 50-cell trays on 10 March. Transplants were set on 18 April in one bay of a multi-bay high tunnel (96' x 200' Haygrove Multibay High Tunnel). The trial was planted into four rows with

each row consisting of one replication. The high tunnel trial had five plants per plot and in-row spacing was 18", which is typical of commercial tomato production. Plastic mulch and drip irrigation were employed and the stake-and-weave method was utilized to trellis the plants vertically. Fertigation was carried out at a rate of 10 lbs nitrogen/acre per application on 29 April, 1 June and 30 June and 1 August. Potassium nitrate was used for the first and third fertigation events and calcium nitrate was used for the second and fourth fertigation. Harvesting was carried out from 28 June through 27 September. During the last harvest, all fruit larger than 5 cm were picked. Fruit were graded for marketability and fruit number and weight were recorded. Average fruit size and percent marketability were determined and are presented below. All data were analyzed using ANOVA (PlotIt, Scientific Programming Enterprises, Haslett, MI), and a mean separation test was carried out by using an F-protected least significant difference (LSD) test. A separate analysis was carried out for each individual observation and the results of the LSD test are shown where statistically significant treatment effects occurred.

Results and Discussion

'Primo Red' had the highest marketable and total yield at 19.6 and 21.6lb per plant respectively. 'Primo Red' also resulted the highest marketable and total yield per plant in our 2013, 2014 and 2015 variety trials. 'Primo Red' marketable yield was statistically similar to 'Red Morning', Red Deuce' and 'BHN589'. 'Red Deuce' had the highest average fruit size in marketability and total resulting in .43 and .42lb respectively. The results were similar in our 2013, 2014 and 2015 variety trials. 'Red Deuce' marketable fruit size was statistically similar to 'Summerpick', 'Skyway', 'Primo Red', and 'Red Morning'. For the third year in a row, 'Primo Red' resulted in the highest percentage marketability by number at 89.7% and by weight at 90.7%.

The major portion (>80%) of the fruit quality problems seen in this trial were the result of blossom end rot (BER). Although the cull fruit were not graded specifically for this issue, the results seen in this study were most likely the result of a lower incidence of BER.

'Primo Red' was a consistent producer throughout the season with an average marketable fruit size of 0.38 lbs/fruit. When reviewing harvesting trends, particularly by marketable fruit weight per plant, three seasonal flushes were observed. There were two large flushes, 14 July and 6 September and one small flush on 25 July. 'Primo Red' had the largest fruit produced on 14 July and tied with 'Red Deuce' on 6 September. During the small flush, 'Primo Red' still produced well and came in the third highest mean fruit weight. 'Red Deuce' produced its largest mean fruit size at that time resulting in .61 lb/fruit.

Another variety that is known for its high lycopene levels, 'Tasti Lee', was also a season consistent producer with smaller fruit between 0.21 and 0.40 lbs/fruit. and had a mid-season flush (from 14 to 25 July) with average fruit size at .40 lbs/fruit. Several varieties showed good potential for early-season production, which can be advantageous for marketing high-value fruit. In particular, 'Primo Red', 'Scarlet Red', and 'BHN 589' showed the highest yields during the mid-weeks of July (data not shown). 'Primo Red', 'Red Deuce' and 'Red Morning' also showed very strong production in the early part of September, which may be useful for growers looking to cater to late markets.

Table 1. Marketable and total per plant fruit yield of tomato varieties grown in a three-season high tunnel in Olathe, Kansas.

	Marketable		Total	
Variety	**Number**	**Wt (lbs)**	**Number**	**Wt (lbs)**
Primo Red	51.9 d	19.6 d	58.0 ab	21.6
Red Morning	48.0 cd	17.9 cd	56.9 ab	20.3
Red Deuce	38.4 abc	16.7 bcd	46.0 a	19.4
BHN 589	47.5 cd	16.2 bcd	62.5 b	20.1
Richmond	43.0 bcd	14.0 abc	48.6 ab	15.9
Tasti Lee	42.7 bcd	13.4 abc	50.7 ab	15.5
Summerpick	33.4 ab	12.9 ab	43.0 a	16.5
Scarlet Red	37.8 abc	12.7 ab	49.9 ab	16.8
Fletcher	40.3 bc	12.6 ab	49.2 ab	15.0
Skyway	28.4 a	10.9 a	45.3 a	16.2
$LSD_{(0.05)}$	10.30	4.83	15.21	6.58

Table 2. Mean tomato fruit size (lbs) and marketability of tomato varieties grown in a three-season high tunnel in Olathe, Kansas.

	Average Fruit Size (lbs)		Percent Marketability	
Variety	**Marketable**	**Total**	**Number**	**Weight**
Red Deuce	0.43 e	0.42 e	83.6% bc	86.2% bc
Summerpick	0.39 de	0.38 de	80.3% bc	81.2% bc
Skyway	0.38 cde	0.35 bcd	64.0% a	68.7% a
Primo Red	0.38 cde	0.37 cde	89.7% c	90.7% c
Red Morning	0.37 bcde	0.36 bcd	84.7% bc	88.1% bc
BHN 589	0.34 abcd	0.32 ab	76.6% b	81.0% bc
Scarlet Red	0.33 abcd	0.33 abcd	78.2% bc	78.6% ab
Richmond	0.32 abc	0.32 abc	88.4% c	88.2% bc
Fletcher	0.32 ab	0.31 ab	82.5% bc	84.5% bc
Tasti Lee	0.31 a	0.30 a	83.4% bc	85.4% bc
$LSD_{(0.05)}$	0.0599	0.0512	11.51	10.55

Acknowledgements

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Seed Sources

Harris Moran - HM
Seedway – SW/SDW
Johnny's Selected Seeds - JS

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Watermelon Variety Evaluations in Southwest Indiana, 2016

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Indiana is one of the major watermelon production areas in the U.S. In 2015, watermelon production in Indiana ranked sixth in harvested area (6,900 acres) and total production (2,415,000 cwt) following Florida, Texas, Georgia, California and South Carolina (USDA, 2016). The majority of watermelons grown in Indiana are triploid watermelons, with a small portion of the acreages growing diploid watermelons (seeded watermelon) and personal-size triploid watermelons. Variety selection based on yield, disease resistance and fruit quality is one of the key decisions in watermelon production. The objective of this study is to provide watermelon producers in Indiana with regional and updated information on triploid, personal-size triploid and diploid watermelon varieties.

Materials and Methods

Three watermelon variety trials were conducted in 2016 in Vincennes, Indiana. The triploid watermelon variety trial included 44 watermelon varieties and two grafted varieties; the personal-size triploid watermelon variety trial included four varieties; the diploid watermelon variety trial included five varieties. Seed sources are provided in Table 2. 'SP-6' was used as the pollinizer for the triploid watermelons.

All the seeds were planted in 50-cell black seeding flats (T.O. Plastics, Clearwater, MN) filled with a peat-based potting media (Metro-Mix 360, a mixture of sphagnum peat moss, coarse perlite, bark ash, starter fertilizer and dolomite). Transplants were grown in greenhouses at the Southwest Purdue Agricultural Center (SWPAC). Seedling dates and transplanting dates are provided in Table 3.

Soil type of the field is Ade loamy fine sand. Soybean was previously grown in the field in 2015. Plants were grown in raised beds covered with black plastic mulch. Drip tape with a 12-inch emitter spacing and flow rate of 0.22 gpm/100 feet were used for irrigation. Fertilizers at the rate of 250 lb/acre urea (46-0-0), 150 lb/acre potash (0-0-60), 100 lb/acre diammonium phosphate (18-46-0), 200 lb/acre dolomite lime, 100 lb/acre K-Mag granular, 7 lb/acre boron 14.3% and 20 lb/acre Zinc 10% LS were broadcast applied prior to laying black plastic mulch. During transplanting, each plant received approximately one cup of starter fertilizer solution (Miracle-Gro, 4.7 grams per gallon water). Pests were managed using recommendations from Melcast (melcast.info) and the *Midwest Vegetable Production Guide for Commercial Growers* (Egel et al., 2016).

Randomized complete block designs with three replications were used in the trials. Experimental plots of the triploid watermelons and diploid watermelons were comprised of 48-ft bed that was spaced on 8 ft centers. Each experimental plot included 12 watermelon plants on 4 ft in-row spacing. Pollenizers were interplanted between every two triploid plants in the same row. The experimental plot of personal-size watermelons was comprised of three 8-ft rows spaced on 6 ft

centers. Plants were planted 2 ft apart for a total of 12 plants per plot. Pollenizers were planted in one row of every three rows of personal-size triploid watermelons.

Harvests were conducted once a week for four weeks on the three trials. Triploid watermelons were harvested from 21 July to 11 Aug. Personal-size triploid watermelons were harvested from 27 July to 18 Aug. Diploid watermelons were harvested from 18 July to 8 Aug. Fruit were weighted individually. Nine fruit of each variety were collected during peak harvest for fruit quality measurements. Fruit size and rind thickness were recorded. Total soluble solids were measured with a digital refractometer. Flesh firmness was measured using a force gauge with 11mm diameter tip. Hollow heart severity was evaluated using a 1-5 scale: 1. none; 2. carpel separation evident; 3. one large gap evident; 4. more than 2 large gaps; 5. severe. Seedlessness was evaluated by counting black hard seeds on cutting surfaces of quartered melons. If there were 10 or more back seeds, the fruit was rated as unacceptable.

Analysis of variance was performed using the Proc Mixed procedure of SAS. Fisher's least significant difference test ($\alpha = 0.05$) was conducted for multiple comparisons of different measurements among watermelon varieties.

Greenhouse Fusarium wilt test

In September of 2016, seeds of the 42 varieties of the field trial plus 3 varieties used for comparison purposes were planted in 6-inch pots in a greenhouse at SWPAC. Each pot was an experimental unit with 3 seedlings and was replicated 3 times. When seedlings had reached the first true leaf stage, 100 ml of the inoculum of *Fusarium oxysporum* f.sp. *niveum* ($1 \text{ X } 10^7$ conidia) were poured into each pot. The Horsfall-Barratt rating scale was used to rate the seedlings 4 times throughout September. The Area Under the Disease Progress Curve (AUDPC) was calculated from these rating using trapezoid integration.

Results and Discussions

Weather condition

During 2016 production season, we had a dry and hot June. Mean temperature in June was 4 °F higher than 30 years' average. August was particularly wet with precipitation more than double of the 30 years' average, which might negatively affect the yield. The temperature in May was cooler than normal, soil temperature did not reach 70 °F until around May 25.

Triploid watermelons

The yields of triploid watermelon varieties ranged from 18,729 to 56,212 lb/acre (Table 4). The top yielding variety was 'Premont', which was also the top yielding variety in the 2015 triploid watermelon variety trial. In addition to 'Premont', marketable yields of grafted 'Fascination', and 'Excursion' were also above 50,000 lb/acre. 12 varieties (Wayfarer, Distinction, Crunchy Red, Traveler, Exclamation, UGR 1763, Wolverine, Embasy, Warrior, KB 12106, Grafted 7197 and Talca) yielded between 50,000 to 45,000 lb/acre. Some of them were first evaluated in the 2016 variety trial. But it is worth noting that 'Traveler', 'KB 12106' and 'Exclamation' were also among the top yielding varieties in the 2015 variety trial.

The fourth highest yielding variety Wayfarer produced the most marketable fruit (3,857) that were mainly in the 60-count category. 'Premont' had the second most marketable fruit (3,705)

mainly in the 45-count category. 'Excursion' ranked second in market yield, but ranked 24th in marketable fruit number since it mainly produced 36-count fruit. Among the varieties that had the yield above 45, 000 lb/acre, 'Traveler' and 'Wayfarer' had most 60-count fruit while others had primarily 45-count fruit (Table 5).

In the first harvest (66 days after transplant), 'Excursion' had higher yield than other varieties. 'Razorback', 'Sweet Dawn', 'Warrior', 'KB12106' also had numerically higher yields in the first harvest. No fruit of 'ORS12.154A', '3F-2186' and 'ORS6064b' was harvested on 21 July, 'ORS6227', '3F-4139' also had low yields on the first harvest date (Table 6 and Figure 1).

Total soluble solids (TSS) ranged from 12.91 to 9.92 °Brix. 'Poseidon' had the highest TSS. It was also one of the sweetest varieties in the 2015 variety trial. Varieties '3F-2186', 'Road Trip', 'Sweet Dawn', 'Joy Ride', 'Summer Breeze', '3F-4221', 'UGR 1763-14', 'HSR 4638' and 'Secretariat', 'Chubbiness', 'HSR4631' also had TSS above 12 °Brix. Grafted '7197' and 'Maxima' had firmer flesh compared with other varieties (Table 7). Ratings of hollow heart severity were generally low in the trial. Of the evaluated nine fruit per variety, 20 of 46 varieties did not have any fruit showing hollow heart symptoms. Most of the fruit did not have black seeds or had just a few. However, 'Fascination', 'Joy Ride', 'Road Trip', 'Embasy', 'Kingman', 'Chubbiness', 'ORS12.154a', and grafted 'Fascination' had one or two fruit among evaluated nine fruit that had more than 10 black seeds (data not shown).

This is the first year that we included grafted watermelons (variety Fascination and 7197) in the variety trial. Both of the grafted varieties yielded higher than their non-grafted counterparts although no significant differences in yields were identified. Interestingly, grafted 7197 had significantly higher values on flesh firmness than non-grafted 7197 (Table 7), which confirmed the previous observation that grafting might increase watermelon flesh firmness in some varieties.

In the greenhouse Fusarium wilt test, symptoms of Fusarium wilt were first observed 8 days post-inoculation. Isolations were made from selected plants upon termination of the experiment to confirm the wilt symptoms observed were caused by *F. oxysporum* f.sp. *niveum*. The triploid varieties KB 12106, Fascination, Sweet Dawn, ORS12.154a, and Distinction had significantly less wilt than 17 triploids. Razorback, Embasy and Crunchy Red had significantly more wilt than 16 triploids (Table 8). The low amount of wilt in the open pollinated variety Calhoun Gray may indicate that the strain of *F. oxysporum* f.sp. *niveum* used was race 1.

Personal-size triploid watermelons

The yields of personal-size triploid watermelons are presented in Table 9. Significant yield differences were observed among the four varieties. Variety Extazy had the highest yield (70,334 lb/acre), followed by Krimson Kiss (68,914 lb/acre), Serval (45,368 lb/acre) and Ocelot (32,595 lb/acre). Variety Ocelot had less fruit compared with other varieties. Average fruit weight of 'Extazy' was similar to 'Krimson Kiss', which were significantly larger than average fruit weights of 'Ocelot' and 'Serval'.

Percentages of fruit in different fruit weight categories are illustrated in Figure 2. Personal-size watermelons range in size from 4 to 9 lb. 'Extazy' and 'Krimson Kiss' had 18.6% and 34.3%

fruit larger than 10 lb, respectively, which may not be marketable as personal-size watermelons. ‘Ocelot’ and ‘Serval’ had 77.8% and 83.9% of fruit ranged in size from 4 to 8 lb, respectively.

Variety ‘Krimson Kiss’ had a significant higher TSS value compared with other varieties, while ‘Extazy’ and ‘Serval’ had the lowest value on TSS (Table 10). ‘Extazy’ and ‘Serval’ had thicker rind compared with ‘Krimson Kiss’ and ‘Ocelot’. The thicker rind can be an advantageous character for shipping, but it also means there is less edible flesh. Differences in fruit length and width among varieties followed the similar trend as average fruit weight. Flesh firmness was similar among varieties at $\alpha = 0.05$ level. Of the evaluated nine fruit per variety, ‘Extazy’ had 1 fruit and ‘Ocelot’ had 2 fruit that had more than 10 black seeds (data not shown). No hollow-heart fruit was observed.

Diploid watermelons

Marketable yield of the five diploid watermelons ranged from 37,723 to 44,849 lb per acre (Table 11). No significant differences in marketable weights were observed among varieties. ‘Royal Sweet’ had the highest marketable yield on the first harvest date (18 July), which accounted for about 50% of the yield in the season (Table 12). ‘Regency’, ‘Santa Matilde’, ‘Sentinel’ and ‘SW8443WL’ had similar yields on 25 July that were higher than ‘Royal Sweet’. No significant differences in marketable yields were observed in the third and fourth harvest among the varieties.

Average fruit weights of ‘Santa Matilde’ and ‘SV8443WL’ were significantly higher than those of ‘Regency’ and ‘Sentinel’. About 50% of ‘Santa Matilde’ fruit were more than 23 lb. Fruit less than 23 lb accounted for 83% and 95% of ‘Sentinel’ and ‘Regency’, respectively. Fruit sizes of ‘Royal Sweet’ ranged from less than 15 lb to more than 27 lb (Table 11, Figure 3).

No significant differences in total soluble solids were observed among varieties. ‘SV8443WL’ had firmer flesh compared with ‘Sentinel’, ‘Regency’ and ‘Royal Sweet’. Fruit length varied among varieties, but fruit widths were similar regardless of fruit sizes (Table 13). No hollow heart fruit was observed in the selected fruit of each variety.

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Table 1. Precipitation; maximal, minimal and average temperatures of 30 years' average and 2016 in Vincennes, IN (data were adapted from Indiana State Climate Office and SWPAC record).

Month	**Precipitation** *inch*		**Max temperature** *°F*		**Min temperature** *°F*		**Mean temperat**ure *°F*	
	Average	*2016*	*Average*	*2016*	*Average*	*2016*	*Average*	*2016*
May	5.93	4.89	76	75	54	54	65	63
June	4.19	3.10	84	90	63	67	74	78
July	4.64	4.78	88	87	66	69	77	77
August	3.41	8.98	87	90	64	69	76	78

Table 2. Varieties and seed sources of triploid watermelon, personal-size triploid watermelon and diploid watermelon varieties in the 2016 watermelon variety trials in southwest Indiana.

Watermelon variety	Seed Source
Triploid watermelon varieties	
7167	Nunhems
7197	Nunhems
3F-2186	Known You
3F-4139	Known You
3F-4221	Known You
Captivation	Syngenta
Charismatic	Sakata
Chubbiness	Known You
Crunchy Red	Harris Moran
Cut Above	Clifton
Distinction	SWPAC stock
Embasy	Nunhems
Exclamation	Syngenta
Excursion-WDL2413	Syngenta
Fascination	Syngenta
G_7197[z]	Tri-Hishtil
G_Fascination[z]	Tri-Hishtil
HSR4638	Hollar
HSR4631	Hollar
Joy Ride	Seminis
KB 12106	K&B
KB 15010 (spotted type)	K&B
Kingman	Sakata
Maxima	Origene
Neptune	Seedway
ORS12.154a	Origene
ORS6064b	Origene
ORS6227	Origene
Poseidon	Seedway
Premont	Clifton
Prime	Known You
Razorback	Highmark
Road Trip	Seminis
Secretariat	Sakata
Sugar Fresh	Syngenta
Summer Breeze	Seminis
Sweet Dawn	Syngenta
Talca	Origene
Traveler	Harris Moran
UGR 1762-14	United Genetics
UGR 1763-14	United Genetics

Watermelon variety	**Seed Source**
Unbridled	Sakata
USAW 90020	US Agriseeds
Warrior	Nunhems
Wayfarer	Harris Moran
Wolverine	Highmark
Personal-size triploid watermelon varieties	
Extazy	Hazera Genetics
Krimson Kiss	Clifton Seed
Ocelot	Hazera Genetics
Serval	Hazera Genetics
Diploid watermelon varieties	
Regency	Seminis
Royal Sweet	SWPAC
Santa Matilde	Seminis
Sentinel	Seminis
SV8443WL	Seminis

[z] G_7197: Grafted 7197; G_Fascination: Grafted Fascination.

Table 3. Seedling and transplanting dates of triploid watermelons, personal-size triploid watermelons, diploid watermelons, and pollinizers in the 2016 watermelon variety trials in southwest Indiana.

Watermelon varieties	Seedling Dates	Transplanting Dates
Triploid watermelon varieties	14 April	16 May
Personal size triploid watermelon varieties	18 April	23 May
Diploid watermelon varieties	15 April	18 May
Pollenizer	12 April	16 May and 23 May

Table 4. Marketable yields and average fruit weights of triploid watermelons in the 2016 watermelon variety trial in southwest Indiana.

Triploid watermelon variety	Weight *lb/A*		Number of fruit per acre		Average fruit weigh *lb*	
7167	36,468	cdefgh[z]	2,685	cdefgjij	13.52	ijklmn
7197	42,001	abcdefg	2,798	bcdefgh	15.06	bcdefgh
3F-2186	31,972	efghij	2,722	bcdefgjij	11.72	pqr
3F-4139	31,852	efghij	2,949	abcdef	10.73	qrs
3F-4221	36,887	bcdefgh	3,063	abcdef	11.82	pqr
Captivation	44,877	abcdef	2,987	abcdef	14.98	bcdefghi
Charismatic	36,232	cdefgh	2,533	defghij	14.31	defghijlm
Chubbiness	30,261	fghij	2,798	bcdefgh	10.86	qrs
Crunchy Red	48,392	abcd	3,327	abcde	14.46	defghijkl
Cut Above	44,645	abcdef	3,290	abcde	13.65	ghijklmn
Distinction	48,841	abcd	3,025	abcdef	16.21	ab
Embasy	47,347	abcde	3,252	abcde	14.58	defghijkl
Exclamation	47,852	abcd	2,911	abcdef	16.27	ab
Excursion-WDL2413	50,391	abc	2,836	bcdefg	17.71	a
Fascination	43,644	abcdefg	2,836	bcdefg	15.40	bcde
G_7197[y]	45,953	abcde	3,063	abcdef	14.90	bcdefghij
G_Fascination[y]	52,429	ab	3,252	abcde	16.15	bc
HSR4638	40,212	bcdefg	2,685	cdefghij	15.06	bcdefgh
HSR4631	36,714	cdefgh	2,647	defghij	13.72	ghijklmn
Joy Ride	36,217	cdefgh	2,458	defghij	14.19	defghijklmn
KB 12106	46,094	abcde	3,063	abcdef	15.07	bcdefg
KB 15010	41,712	abcdefg	3,176	abcde	13.11	lmnop
Kingman	43,322	abcdefg	2,836	bcdefg	15.25	bcdef
Maxima	29,957	fghij	1,815	hij	16.48	ab
Neptune	40,282	bcdefg	2,949	abcdef	13.71	ghijklmn
ORS12.154a	19,792	ij	1,891	ghij	10.36	rs
ORS6064b	18,729	j	1,777	ij	10.17	s
ORS6227	34,424	defghi	2,571	defghij	13.39	jklmno
Poseidon	40,969	abcdefg	3,214	abcde	12.68	nop
Premont	56,212	a	3,706	ab	15.13	bcdefg
Prime	32,057	efghij	2,685	cdefghij	11.92	opq
Razorback	39,294	bcdefg	2,836	bcdefg	13.99	efghijklmn
Road Trip	34,418	defghi	2,420	efghij	14.17	efghijklmn
Secretariat	38,051	bcdefgh	2,911	abcdef	13.08	lmnop
Sugar Fresh	42,343	abcdefg	2,798	bcdefgh	15.12	bcdefg
Summer Breeze	28,366	ghij	2,080	fghij	13.59	hijklmn
Sweet Dawn	27,242	hij	1,739	j	15.70	bcd
Talca	45,548	abcde	2,798	bcdefgh	16.25	ab
Traveler	48,383	abcd	3,668	abc	13.20	klmnop
UGR 1762-14	35,911	defgh	2,647	defghij	13.53	ijklmn
UGR 1763-14	47,618	abcd	3,441	abcd	13.84	fghijklmn
Unbridled	38,315	bcdefg	2,647	defghij	14.51	defghijkl
USAW 90020	37,774	bcdefgh	2,760	bcdefghi	13.77	fghijklmn
Warrior	47,219	abcde	3,214	abcde	14.67	cdefghijk
Wayfarer	49,614	abc	3,857	a	12.86	mnop
Wolverine	47,430	abcd	3,252	abcde	14.65	cdefghijk

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

[y]G_7197: Grafted 7197; G_Fascination: Grafted Fascination.

Table 5. Percentages of triploid watermelons in fruit weight categories in the 2016 watermelon variety trial in southwest Indiana.

Triploid watermelon variety	**< 9 lb**	**9-13.5 lb** ***60 count***	**13.6-17.5 lb 45 count**	**17.6-21.4 lb** ***36 count***	**>21.5 lb** ***30 count***
7167	12.7[y]	38.1	39.4	8.4	1.4
7197	2.7	25.7	52.7	16.2	2.7
3F-2186	16.7	51.4	29.2	2.8	0
3F-4139	30.3	53.9	15.8	0	0
3F-4221	17.3	49.4	30.9	2.5	0
Captivation	8.9	26.6	39.2	20.2	5.1
Charismatic	6.0	37.3	38.8	14.9	3.0
Chubbiness	21.6	62.2	16.2	0	0
Crunchy Red	6.9	32.2	44.8	13.8	2.3
Cut Above	9.3	37.0	43.0	10.5	0
Distinction	1.2	26.2	43.7	16.2	12.5
Embasy	3.4	39.1	43.7	10.3	3.4
Exclamation	0	25	43.2	22.4	9.2
Excursion-WDL2413	6.1	12.1	24.2	37.9	19.7
Fascination	2.7	29.3	36.0	26.7	5.3
G_7197[z]	5.0	29.6	35.8	25.9	3.7
G_Fascination[z]	8.1	16.3	33.7	32.5	9.3
HSR4638	5.6	22.5	50.7	21.1	0
HSR4631	7.1	37.1	42.9	12.9	0
Joy Ride	9.2	30.8	30.8	24.6	4.6
KB 12106	2.5	22.2	61.7	12.3	1.2
KB 15010 (spotted type)	7.1	50.0	33.3	9.5	0
Kingman	4.0	24.0	44.0	24.0	4.0
Maxima	2.3	20.4	38.6	25.0	13.6
Neptune	2.6	39.7	44.8	12.8	0
ORS12.154a	31.4	56.9	11.8	0	0
ORS6064b	27.9	63.8	8.5	0	0
ORS6227	13.2	41.2	35.3	7.3	2.9
Poseidon	9.4	49.4	40.0	1.2	0
Premont	4.1	21.4	55.1	16.3	3.1
Prime	16.9	54.9	26.8	1.4	0
Razorback	8.0	34.7	45.3	12.0	0
Road Trip	9.4	28.1	46.9	14.1	1.5
Secretariat	16.9	33.8	41.5	6.5	1.3
Sugar Fresh	4.3	30.4	40.6	21.7	2.9
Summer Breeze	9.1	36.3	47.2	7.3	0
Sweet Dawn	0	23.7	44.7	28.9	2.6
Talca	0	28.4	33.8	27.0	10.8
Traveler	10.3	44.3	36.1	9.3	0
UGR 1762-14	6.0	44.8	38.8	10.4	0
UGR 1763-14	3.3	37.4	54.9	4.4	0
Unbridled	10.0	31.4	34.3	21.4	2.8
USAW 90020	2.7	47.9	39.7	9.6	0
Warrior	5.9	28.2	50.6	14.1	1.2
Wayfarer	14.5	42.7	36.9	4.8	1.0
Wolverine	4.6	26.7	54.6	11.6	2.3

[z]G_7197: Grafted 7197; G_Fascination: Grafted Fascination.

[y]Statistical analyses were not included.

Table 6. Marketable yields of triploid watermelons in the first (66 days after transplanting, DAT) harvest in the 2016 watermelon variety trial in southwest Indiana.

Triploid watermelon variety	**Weight** *lb/A*	**Number of fruit per acre**
7167	4,077 [y]	265
7197	5,708	378
3F-2186	0	0
3F-4139	886	113
3F-4221	1,064	75
Captivation	1,464	75
Charismatic	2,784	189
Chubbiness	3,989	340
Crunchy Red	3,154	227
Cut Above	2,656	189
Distinction	3,759	265
Embasy	2,421	151
Exclamation	5,909	340
Excursion-WDL2413	11,437	605
Fascination	5,090	302
G_7197[z]	3,811	227
G_Fascination[z]	1,652	113
HSR4638	2,228	151
HSR4631	1,309	76
Joy Ride	5,453	302
KB 12106	7,185	454
KB 15010 (spotted type)	6,187	454
Kingman	2,896	189
Maxima	1,367	76
Neptune	1,741	113
ORS12.154a	0	0
ORS6064b	0	0
ORS6227	501	38
Poseidon	4,187	302
Premont	4,136	265
Prime	4,835	340
Razorback	7,459	529
Road Trip	6,185	378
Secretariat	5,079	378
Sugar Fresh	1,139	76
Summer Breeze	5,782	378
Sweet Dawn	7,423	454
Talca	1,824	113
Traveler	1,490	113
UGR 1762-14	2,307	151
UGR 1763-14	5,549	378
Unbridled	2,812	189
USAW 90020	2,914	189
Warrior	7,243	454
Wayfarer	5,108	415
Wolverine	2,415	151

[z] G_7197: Grafted 7197; G_Fascination: Grafted Fascination.

[y] Statistical analyses were not included.

Table 7. Fruit quality of triploid watermelon varieties in the 2016 watermelon variety trial in southwest Indiana.

Triploid watermelon variety	**Total soluble solids** *°Brix*		**Firmness** *lbs-force*		**Rind thickness** *in*		**Fruit length** *in*		**Fruit width** *in*		**Hollow heart**[z]	
7167	11.49	defghijk[y]	2.50	defgh	0.73	bcd	11.32	bcdefg	8.92	efghijklm	1	d
7197	11.39	efghijkl	2.65	bcdefgh	0.73	bcd	10.99	defghijk	8.93	efghijklm	1.11	cd
3F-2186	12.77	ab	2.31	fgh	0.69	bcd	11.21	bcdefghi	8.48	mnop	1.33	bc
3F-4139	11.33	efghijkl	2.34	efgh	0.65	cd	9.04	p	8.58	lmnop	1	d
3F-4221	12.22	abcdef	2.83	abcdefg	1.00	a	9.24	op	8.79	ghijklm	1	d
Captivation	11.18	fghijkl	2.53	cdefgh	0.70	bcd	11.35	bcdefg	9.31	bcdefg	1.89	a
Charismatic	11.96	abcdefghi	2.37	efgh	0.78	abcd	10.59	fghijklm	9.37	bcdef	1	d
Chubbiness	12.09	abcdefgh	2.35	efgh	0.61	cd	10.00	lmno	8.18	nop	1	d
Crunchy Red	11.22	fghijkl	3.08	abcde	0.70	bcd	11.97	abc	8.92	efghijklm	1	d
Cut Above	11.62	cdefghij	2.37	efgh	0.69	bcd	11.14	cdefghij	9.22	bcdefghij	1.11	cd
Distinction	10.72	jklm	2.90	abcdef	0.75	bcd	10.58	fghijklm	9.97	a	1.22	bcd
Embasy	11.32	efghijkl	2.91	abcdef	0.66	bcd	10.84	defghijkl	8.77	hijklm	1.33	bc
Exclamation	11.23	fghijkl	2.70	bcdefgh	0.76	bcd	10.67	efghijklm	9.44	abcde	1.11	cd
Excursion-WDL2413	10.67	jklm	2.64	bcdefgh	0.65	cd	12.00	abc	9.39	bcde	1.11	cd
Fascination	10.96	ijklm	2.60	bcdefgh	0.71	bcd	11.37	bcdefg	9.21	bcdefghij	1.33	bc
G_7197[x]	11.40	efghijkl	3.43	a	0.78	abcd	11.40	bcdef	8.81	ghijklm	1	d
G_Fascination[x]	11.29	efghijkl	3.13	abcd	0.71	bcd	12.06	ab	9.26	bcdefgh	1.11	cd
HSR4638	12.12	abcdefgh	2.31	fgh	0.73	bcd	10.33	ijklmn	9.70	ab	1.11	cd
HSR4631	12.11	abcdefgh	2.23	fgh	0.68	bcd	9.83	mnop	9.29	bcdefgh	1.11	cd
Joy Ride	12.62	abc	2.85	abcdefg	0.66	bcd	10.99	defghijk	8.86	fghijklm	1.11	cd
KB 12106	11.64	cdefghij	3.20	abc	0.64	cd	11.12	cdefghij	8.69	jklm	1	d
KB 15010	10.38	klm	2.48	defgh	0.70	bcd	10.75	defghijk	8.50	mnop	1.4	b
Kingman	11.42	efghijkl	2.49	defgh	0.78	abcd	11.27	bcdefgh	9.09	defghijkl	1	d
Maxima	10.96	ijklm	3.47	a	0.70	bcd	10.05	lmno	9.65	abc	1	d
Neptune	11.14	fghijklm	2.53	cdefgh	0.69	bcd	10.36	ijklmn	9.20	bcdefghij	1	d
ORS12.154a	10.32	lm	2.85	abcdefg	0.69	bcd	10.51	ghijklmn	8.08	p	1	d
ORS6064b	9.92	m	3.12	abcde	0.67	bcd	9.95	lmnop	8.10	op	1	d
ORS6227	10.58	jklm	2.36	efgh	0.81	abc	12.49	a	8.78	ghijklm	1	d
Poseidon	12.91	a	2.38	efgh	0.80	abc	10.95	defghijk	8.81	ghijklm	1.11	cd
Premont	11.22	fghijkl	3.27	ab	0.72	bcd	11.21	bcdefghi	9.24	bcdefghi	1	d

Triploid watermelon variety	Total soluble solids °*Brix*		Firmness *lbs-force*		Rind thickness *in*		Fruit length *in*		Fruit width *in*		Hollow heart[z]	
Prime	11.64	cdefghij	2.01	h	0.68	bcd	10.41	hijklmn	8.63	lmno	1.22	bcd
Razorback	11.97	abcdefghi	2.83	abcdefg	0.73	bcd	10.07	lmno	9.06	defghijkl	1	d
Road Trip	12.68	abc	2.43	efgh	0.69	bcd	11.31	bcdefg	8.78	hijklm	1	d
Secretariat	12.03	abcdefghi	2.65	bcdefgh	0.77	bcd	10.87	defghijkl	8.95	defghijklm	1	d
Sugar Fresh	11.16	fghijklm	2.66	bcdefgh	0.75	bcd	11.52	bcde	9.20	bcdefghij	1.22	bcd
Summer Breeze	12.39	abcde	2.89	abcdef	0.62	cd	10.59	fghijkl	9.47	abcd	1	d
Sweet Dawn	12.60	abcd	2.24	fgh	0.57	d	11.56	bcd	9.18	bcdefghij	1	d
Talca	10.61	jklm	2.46	defgh	0.87	ab	11.36	bcdefg	9.22	bcdefghij	1	d
Traveler	11.03	hijklm	2.88	abcdef	0.65	cd	10.27	jklmn	8.92	efghijklm	1	d
UGR 1762-14	11.97	abcdefghi	2.51	cdefgh	0.62	cd	10.65	efghijklm	8.79	ghijklm	1.22	bcd
UGR 1763-14	12.16	abcdefg	2.61	bcdefh	0.73	bcd	11.50	bcde	8.73	ijklm	1	d
Unbridled	11.06	ghijklm	2.22	fgh	0.83	abc	10.16	klmn	9.21	bcdefghij	1	d
USAW 90020	10.81	jklm	2.17	gh	0.73	bcd	11.06	defghij	9.13	cdefghijk	1.17	bcd
Warrior	10.79	jklm	2.82	abcdefg	0.69	bcd	11.13	cdefghij	8.92	efghijklm	1.22	bcd
Wayfarer	11.67	bcdefghij	3.24	ab	0.73	bcd	9.65	nop	9.01	defghijklm	1	d
Wolverine	11.48	efghijk	3.10	abcde	0.75	bcd	10.13	klmn	9.22	bcdefghij	1.17	bcd

[z]Hollow heart severity was evaluated using a 1-5 scale: 1. None; 2. Carpel separation evident; 3. One large gap evident; 4. More than 2 large gaps; 5. severe.

[y]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

[x]G_7197: Grafted 7197; G_Fascination: Grafted Fascination

Table 8. Severity of Fusarium wilt of 42 seedless varieties as determined in a greenhouse trial conducted at the Southwest Purdue Agriculture Center in September 2016.

Triploid watermelon variety[z]	AUDPC	Rank out of 45
7167	128.80 bcdefghijk[x]	19
7197	163.51 bcdefgh	14
3F-2186	204.61 bcd	4
3F-4139	189.26 bcdef	6
3F-4221	179.77 bcdef	10
Black Diamond[y]	46.98 jklm	39
Calhoun Gray[y]	13.95 lm	44
Captivation	77.60 fghijklm	35
Charismatic	115.99 bcdefghijklm	21
Charleston Gray[y]	78.07 efghijklm	34
Chubbiness	59.26 ghijklm	36
Crunchy Red	212.17 abc	3
Cut Above	55.32 hijklm	37
Distinction	31.94 klm	40
Embasy	224.23 ab	2
Exclamation	170.51 bcdefg	12
Excursion	49.56 ijklm	38
Fascination	18.37 klm	43
HSR4631	78.40 efghijklm	33
HSR4638	184.99 bcdef	8
Joy Ride	129.46 bcdefghijk	18
KB 12106	3.57 m	45
KB 15010	105.04 cdefghijklm	24
Kingman	92.41 defghijklm	29
Maxima	161.67 bcdefghi	15
Neptune	122.96 bcdefghijkl	20
ORS12.154a	30.04 klm	41
ORS6064b	164.11 bcdefgh	13
ORS6227	91.17 efghijklm	31
Poseidon	187.51 bcdef	7
Premont	100.93 cdefghijklm	25
Prime	184.93 bcdef	9
Razorback	324.53 a	1
Road Trip	170.85 bcdefg	11
Secretariat	95.56 defghijklm	27
Sugar Fresh	190.91 bcde	5
Summer Breeze	150.55 bcdefghij	17
Sweet Dawn	23.78 klm	42
Talca	91.64 defghijklm	30
Traveler	89.89 efghijklm	32
Unbridled	153.85 bcdefghij	16
USAW 90020	93.72 defghijklm	28
Warrior	100.30 cdefghijklm	26
Wayfarer	106.39 cdefghijklm	23
Wolverine	109.00 cdefghijklm	22

[z]Varieties UGR-1762-14, UGR-1763-14 and the grafted 7197 and Fascination are not included in the Fusarium wilt trial.
[y]Black Diamond, Charleston Gray and Calhoun Gray are open pollinated varieties included for comparison purposes.
[x]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 9. Marketable yields and average fruit weights of personal-size triploid watermelons in the 2016 watermelon variety trial in southwest Indiana.

Personal-size triploid watermelon Variety	**Weight** *lb/A*		**Number of fruit per acre**		**Average fruit weight** *lb*	
Extazy	70,334	a[z]	8,224	a	8.5	a
Krimson Kiss	68,914	b	7,430	a	9.38	a
Ocelot	32,595	d	4,594	b	7.16	b
Serval	45,368	c	7,033	a	6.44	b

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 10. Fruit quality of personal-size triploid watermelons in the 2016 watermelon variety trial in southwest Indiana.

Personal-size triploid watermelon Variety	**Total soluble solids** *°Brix*		**Firmness** *lbs-force*		**Rind thickness** *in*		**Length** *in*		**Width** *in*	
Extazy	10.63	c[z]	3.82	a	0.65	a	8.20	a	7.72	a
Krimson Kiss	12.43	a	3.02	a	0.55	b	8.33	a	7.48	a
Ocelot	11.04	b	4.01	a	0.54	b	7.69	b	6.87	b
Serval	10.46	c	4.35	a	0.66	a	7.21	c	6.93	b

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 11. Marketable yields and average fruit weights of diploid watermelons in the 2016 watermelon variety trial in southwest Indiana.

Diploid watermelon variety	**Weight** *lb/A*		**Number of fruit per acre**		**Average fruit weight** *lb*	
Regency	44,849	a	2,420	a[z]	18.47	c
Royal Sweet	42,476	a	2,080	ab	20.37	bc
Santa Matilde	37,783	a	1,588	b	23.76	a
Sentinel	40,611	a	2080	ab	19.47	c
SV8443WL	37,723	a	1,739	b	21.88	ab

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 12. Marketable yields of diploid watermelons on each harvest date in the 2016 watermelon variety trial in southwest Indiana.

Diploid watermelon variety	July 18				July 25				August 1				August 8			
	Weight (lb) per acre		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*		*Weight (lb) per acre*		*Number of fruit per acre*	
Regency	9,332	b[z]	454	b	25,168	a	1,361	a	7,931	a	453	a	2418	a	151	a
Royal Sweet	21,140	a	907	a	13,992	b	794	b	2,371	a	113	a	4974	a	265	a
Santa Matilde	12,402	b	529	b	19,982	ab	832	b	2,678	a	113	a	2721	a	113	a
Sentinel	9,517	b	491	b	22,480	a	1,097	ab	5,616	a	302	a	2998	a	189	a
SV8443WL	12,662	b	529	b	18,812	ab	870	b	2,901	a	151	a	3348	a	189	a

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

Table 13. Fruit quality of diploid watermelons in the 2016 watermelon variety trial in southwest Indiana.

Variety	Total soluble solids *°Brix*		Firmness *lbs-force*		Rind *in*		Fruit length *in*		Fruit width *in*	
Regency	11.54	a	2.03	b[z]	0.64	a	13.09	bc	8.73	a
Royal Sweet	11.48	a	2.04	b	0.72	a	12.82	c	8.86	a
Santa Matilde	11.38	a	2.38	ab	0.66	a	14.48	a	9.02	a
Sentinel	11.74	a	2.03	b	0.67	a	13.61	abc	9.01	a
SV8443WL	11.58	a	2.72	a	0.71	a	13.94	ab	9.01	a

[z]Means within a column followed by the same letter are not significantly different according to Fisher's least significant difference test at $P \leq 0.05$.

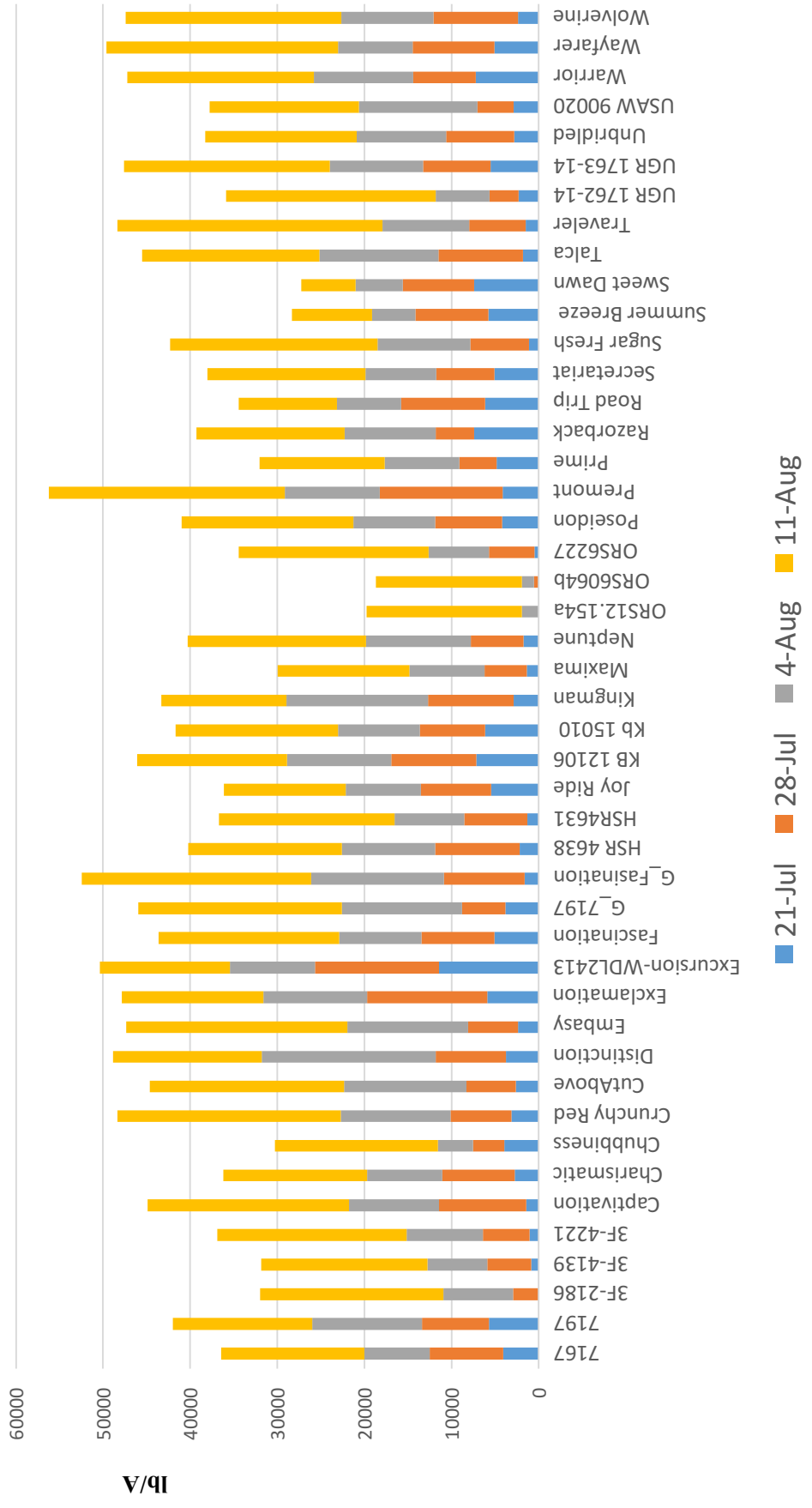

Figure 1. Yield of triploid watermelon varieties on each harvest date in the 2016 watermelon variety trial in southwest Indiana.

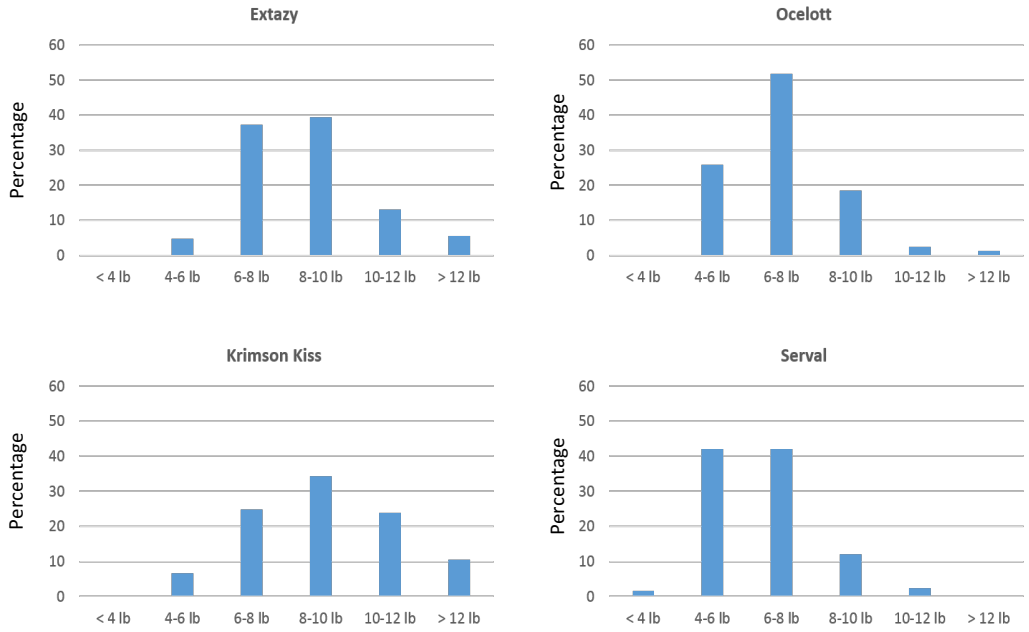

Figure 2. Percentage of personal-size triploid watermelons in each weight category in the 2016 watermelon variety trial in southwest Indiana.

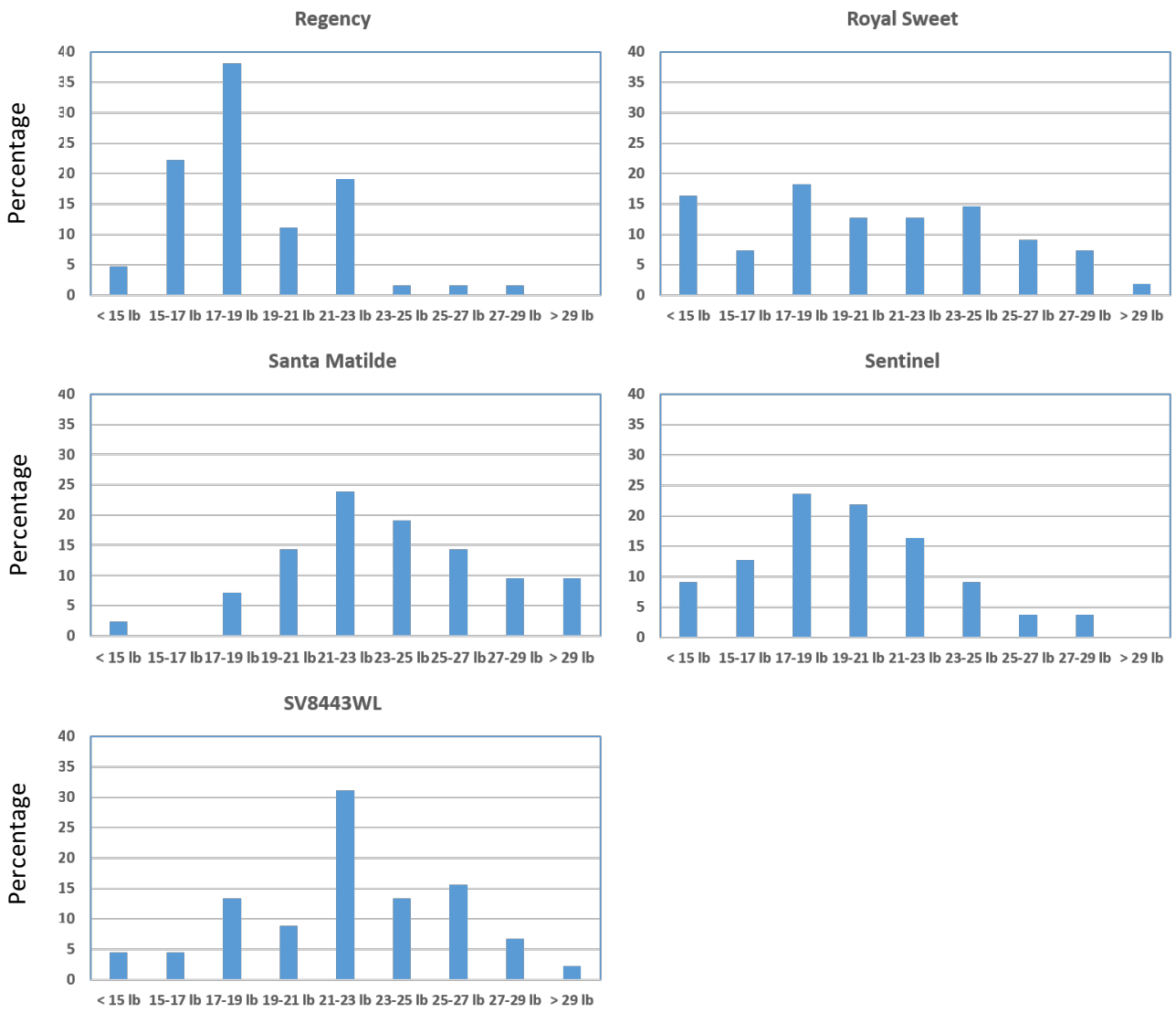

Figure 3. Percentage of diploid watermelons in each weight category in the 2016 watermelon variety trial in southwest Indiana.

Figure 4. Exterior and interior of triploid watermelon varieties in the 2016 personal-size triploid watermelon variety trial in southwest Indiana. ***1.*** 7167; ***2.*** 7197; ***3.*** 3F-2186; ***4***. 3F-4139; ***5.*** 3F-4221; ***6.*** Captivation; ***7.*** Charismatic; ***8.*** Chubbiness; ***9.*** Crunchy Red; ***10***. Cut Above; ***11***. Distinction; ***12***. Embasy; ***13***. Exclamation; ***14***. Excursion-WDL2413; ***15***. Fascination; ***16***. G_7197; ***17***. G_Fascination; ***18***. HSR 4638; ***19***. HSR 4631; ***20***. Joy Ride; ***21***. KB 12106; ***22***. Kb 15010 (spotted type); ***23***. Kingman; ***24***. Maxima; ***25***. Neptune; ***26***. ORS12.154a; ***27***. ORS6064b; ***28***. ORS6227; ***29***. Poseidon; ***30***. Premont; ***31***. Prime; ***32***. Razorback; ***33***. Road Trip; ***34.*** Secretariat; ***35***. Sugar Fresh; ***36***. Summer Breeze; ***37***. Sweet Dawn; ***38.*** Talca; ***39***. Traveler; ***40***. UGR 1762-14; ***41***. UGR 1763-14; ***42***. Unbridled; ***43***. USAW 90020; ***44***. Warrior; ***45***. Wayfarer; ***46***. Wolverine.

Figure 5. Exterior and interior of personal-size triploid watermelon varieties in the 2016 watermelon variety trial in southwest Indiana.

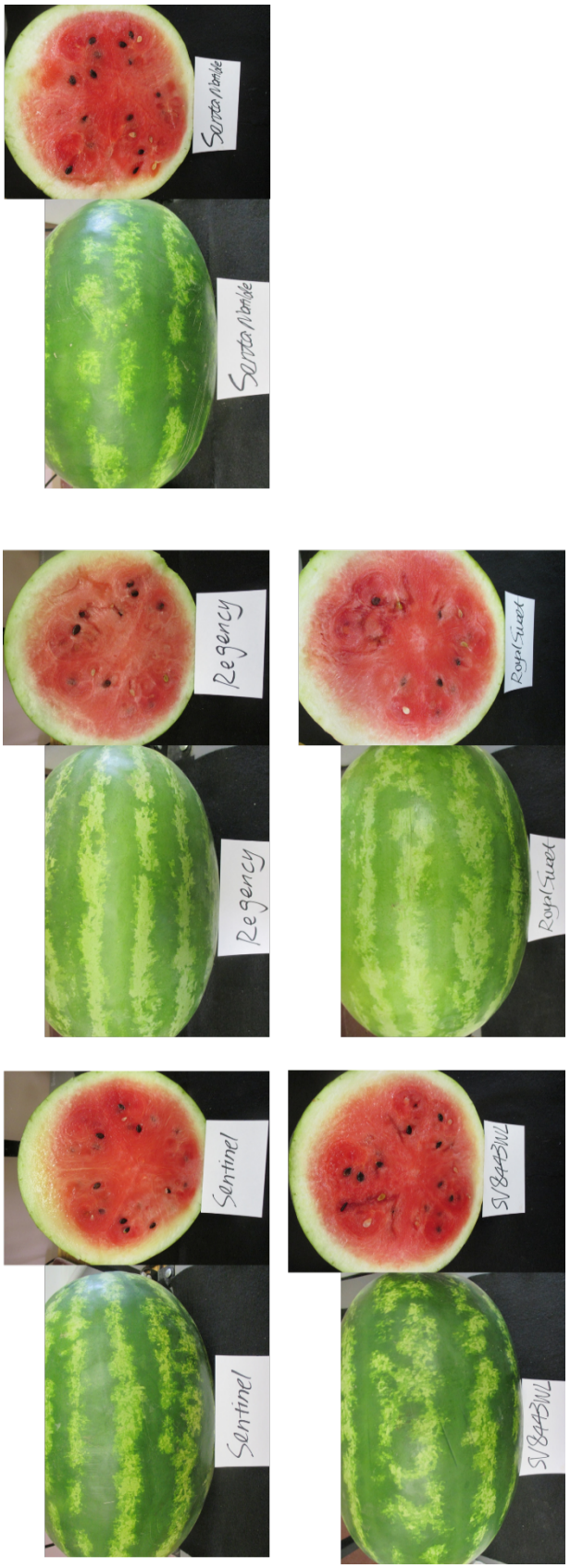

Figure 6. Exterior and interior of diploid watermelon varieties in the 2016 watermelon variety trial in southwest Indiana.

Kentucky Seedless Watermelon Variety Trial, 2016

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Based on the most recent census data, watermelon is the second largest planted vegetable crop in Kentucky (USDA, 2013). Watermelon is a favorite summertime treat and has been increasing in acreage as have vegetables as a whole in the state (Snell et al., 2013). It is both marketed directly and via wholesale with production scattered throughout the state. Some areas of concentrated watermelon production include Allen, Casey, Christian, Daviess, Hart, Lincoln, Scott, Taylor, and Todd Counties.

Variety selection continues to be a primary consideration for farmers so they can make decisions to suit their needs in yield and disease resistance while also suiting their buyers' needs for quality and appearance. Based on an individual's market channels, their needs may differ for varieties. The objective of the experiment was to evaluate thirty-five seedless watermelon varieties produced under local conditions in Central Kentucky.

Materials and Methods

Thirty-five varieties were sown in fifty-cell black seedling flats (Landmark Plastic, Akron, OH) on 18 April and placed in a transplant production greenhouse at the University of Kentucky Horticulture Research Farm in Lexington, KY. The seedling media used was Jiffy-Mix #17 (Jiffy Products of America, Lorain, Ohio) which is a peat and vermiculate blend. The non-harvested pollenizer SP-6 was sown at the same time as the seedless varieties. Pre-emergent herbicide, Command, was applied 24 April at 0.67 pt/acre. All varieties, as well as the non-harvested pollinizer, were transplanted on 23 May with a Rain-Flo waterwheel setter into a Maury silt loam at a commercial vegetable farm in Scott County, Kentucky. Experimental plots were 40 ft. in length with ten seedless plants per plot. Rows were spaced on 8 ft. centers with 4 ft. in-row spacing. Pollenizers were interplanted within the row at a ratio of one pollenizer for every two trial plants. The experiment was a randomized complete block design with three replications. Urea (46-0-0) and muriate of potash (0-0-60) were applied pre-plant at 110 lbs. and 83.5 lbs., respectively with amounts based on soil test results. A Rain-Flo plastic layer was used to form raised beds and install black plastic-mulch (4 ft x 1 mil, Filmtech Plastics of the Sigma Plastics Group, Lyndhurst, NJ) with drip tape (12 inch emitter spacing, 30 gph/100 ft, Aqua Traxx, The Toro Company, Bloomington, MN) under the plastic. Fertigation was started on 27 May and done on a weekly basis through 5 August using calcium nitrate or potassium nitrate. Nine pounds of nitrogen per acre were applied at each fertigation event. Between the dates of 10 June and 1 July vines were turned back onto the plastic weekly to keep varieties separated and to allow for management of weeds in the row middles. Weekly scouting in conjunction with the use of the (ID-36) Vegetable Production Guide for Commercial Growers (Saha et al, 2015) to select fungicides and insecticides and to properly rotate between pesticide modes of action. MELCAST was utilized to determine the timing of preventative fungicide sprays (Egel, 2014).

There is a potential for a reduction in two – three fungicide applications when utilizing this disease forecasting system (Egel and Latin, 2012).

Five total harvests were collected on a weekly basis beginning 19 July with the final harvest on 16 August. All fruit was weighed individually with any fruit weighing less than nine pounds not considered marketable. Post-harvest analysis was conducted on four fruit from every variety and replication for Brix, flesh firmness, hollow heart rating, and black seed production. Brix were measured using a refractometer (RF-12, Extech Instruments, Nashua, New Hampshire). An analog penetrometer (FT, Wagner Instruments, Greenwich, Connecticut) was used for measuring fruit firmness using a 7/16 of an inch diameter cylindrical probe. Black seeds were counted by cutting the melon into half both lengthways and crossways and counting seeds on the cut faces of the fruit (USDA, 2006). Yield data were analyzed by general linear model and means were separated by Fisher's least significant difference test using SAS statistical programs (SAS Institute, Cary, NC.)

Results and Discussion

Yields in 2016 were higher than last season with a high yield of 61,522 lbs/acre as compared to 40,500 lbs/acre (Table 1) (Saha et al., 2015). Talca had statistically greater yield (61,522 lbs/acre) when compared to thirty-two of the other thirty-four varieties being evaluated including the standard Fascination (Table 1). Talca (3,448.5 fruit/acre) had statistically greater fruit number per acre harvested as compared to twenty-six of the varieties evaluated (Table 1). Other comparable varieties with regards to fruit number includes: Maxima, Neptune, Summer Breeze, Razorback, Exclamation, Crunchy Red, Wolverine, and Joy Ride. Talca had greater total bins per acre (86.7) as compared to all but one of the varieties, Maxima (Table 2). Talca was larger in size as 48% of the fruit harvested were in the 36 or 30-count size with 38% in the 45-count size (Table 2).

There were no statistically significant differences in percentage of fruit harvested in the 45-count size amongst varieties (Table 2). Varieties that did not differ statistically from Maxima for total bins per acre that had 40% or greater fruit in the 45-count size include: Unbridled, Wolverine, Joy Ride, Exclamation, and Crunchy Red (Table 2). Varieties that did not differ statistically from Maxima for total bins per acre that had 35% or greater fruit in the 60-count size include: Neptune (46%) and Summer Breeze (38%) (Table 2).

Sweet Dawn (34%) had greater percentage of fruit in the 36-count size as compared to twenty two of the varieties evaluated (Table 2). Other varieties that did not differ statistically from Sweet Dawn that had comparable total bin yields when compared with Maxima, includes: Wolverine, Crunchy Red, Joy Ride, Razorback, and Summer Breeze (Table 2). Maxima (28%), Talca (24%), and Excursion (23%) produced significantly more fruit in the 30-count size as compared to thirty one of the other varieties (Table 2).

Road Trip (11.9%) had an average brix statistically greater than twenty-five of the varieties evaluated (Table 3). Other varieties comparable to Road Trip with regards to brix that also had a

yield greater than fifty bins per acre included: Summer Breeze, Wolverine, Razorback, Joy Ride, and Unbridled (Table 3). Maxima (10.8%) and Talca (10.3%) did not differ significantly from several varieties that had an average Brix of 11% or greater, while having greater yield (Table 2 and 3).

Only two varieties averaged greater than the maximum (10) number of allowable black seeds to be marketed as a seedless watermelon per the USDA grading standards. Those varieties were Wayfarer (14.5) and UGR 1317-12 (11.8) (Table 3). Fruit firmness ranged from 2.1 to 4.5 lbs-force with ORS 6064B having greater flesh firmness as compared to thirty-two other varieties (Table 3). Conversely, Prime (2.1 lbs-force) had softer flesh when compared to twenty-six of the varieties in the trial (Table 3). There was no statistically significant differences amongst varieties with regards to hollow heart, which was generally low this season.

In summary, varietal selection is a critical choice in preparation for each season. Further, varieties should be shown to have proven and consistent performance in our region over multiple seasons. While the results discussed here are of only one season, many of these varieties have been also seen in the last three seasons. Talca and Maxima have consistently performed well for yield and quality the last three seasons with regard to yield and quality. Other varieties performing well over multiple seasons include: Road Trip, Wolverine, Razorback, Joyride, and Unbridled. Lastly, these were all better or comparable to Fascination with regard to yield and quality, a variety widely used in the southeast and the most utilized in Kentucky comprising nearly 40% of the total watermelon acreage.

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Table 1. Yield of seedless watermelon varieties, 2016.

Variety	Seed Source	Total Fruit Weight (lbs) per plot[z]		Total Fruit Number per plot		Fruit Weight (lbs) per acre		Fruit Number per acre	
Talca	OG	452.0	A[y]	25.3	A	61,522	A	3,448.5	A
Maxima	OG	382.0	AB	21.0	AB	52,001	AB	2,858.6	AB
Exclamation	SY	345.6	ABC	20.0	ABC	47,045	ABC	2,722.5	ABC
Excursion	SY	319.8	BCD	18.0	BCD	43,535	BCD	2,450.3	BCD
Razorback	HI	311.6	BCDE	20.3	ABC	42,410	BCDE	2,767.9	ABC
Crunchy Red	HM	310.9	BCDE	20.0	ABC	42,320	BCDE	2,722.5	ABC
Summer Breeze	S	307.8	BCDEF	20.3	ABC	41,892	BCDEF	2,767.9	ABC
Wolverine	HI	307.6	BCDEF	18.7	ABCD	41,865	BCDEF	2,541.0	ABCD
Neptune	SW	307.5	BCDEF	21.0	AB	41,852	BCDEF	2,858.6	AB
Joy Ride	S	295.0	BCDEFG	18.7	ABCD	40,159	BCDEFG	2,541.0	ABCD
Unbridled	SK	280.8	BCDEFGH	18.3	BCD	38,219	BCDEFGH	2,495.6	BCD
Kingman	SK	270.6	CDEFGH	18.0	BCD	36,838	CDEFGH	2,450.3	BCD
UGR 1762-14	UG	263.5	CDEFGHI	17.0	BCDE	35,864	CDEFGHI	2,314.1	BCDE
UGR 1317-12	UG	261.9	CDEFGHI	14.0	CDEF	35,647	CDEFGHI	1,905.8	CDEF
Charismatic	SK	260.8	CDEFGHI	15.3	BCDEF	35,501	CDEFGHI	2,087.3	BCDEF
KB12106	KB	260.1	CDEFGHI	17.3	BCD	35,404	CDEFGHI	2,359.5	BCD
Sweet Dawn	SY	253.9	CDEFGHI	15.3	BCDEF	34,567	CDEFGHI	2,087.3	BCDEF
KB15010	KB	248.4	CDEFGHI	17.7	BCD	33,811	CDEFGHI	2,404.9	BCD
Road Trip	S	247.6	CDEFGHI	17.0	BCDE	33,702	CDEFGHI	2,314.1	BCDE
Fascination	SY	246.6	CDEFGHI	15.7	BCDEF	33,571	CDEFGHI	2,132.6	BCDEF
ORS 6227	OG	245.0	CDEFGHI	15.0	BCDEF	33,355	CDEFGHI	2,041.9	BCDEF
Secretariat	SK	237.4	CDEFGHIJ	16.3	BCDE	32,312	CDEFGHIJ	2,223.4	BCDE
Traveler	HM	236.6	CDEFGHIJ	16.7	BCDE	32,207	CDEFGHIJ	2,268.8	BCDE
Captivation	SY	231.9	DEFGHIJ	16.3	BCDE	31,572	DEFGHIJ	2,223.4	BCDE
UGR 1763-14	UG	227.8	DEFGHIJ	14.3	BCDEF	31,002	DEFGHIJ	1,951.1	BCDEF
Sugar Fresh	SY	204.0	EFGHIJ	14.3	BCDEF	27,765	EFGHIJ	1,951.1	BCDEF
Wayfarer	HM	199.7	FGHIJ	14.3	BCDEF	27,184	FGHIJ	1,951.1	BCDEF
Poseidon	SW	193.8	GHIJ	14.7	BCDEF	26,379	GHIJ	1,996.5	BCDEF
ORS 6064B	OG	192.0	GHIJ	14.3	BCDEF	26,131	GHIJ	1,951.1	BCDEF
Prime	KU	180.3	HIJ	12.7	DEF	24,540	HIJ	1,724.3	DEF
3F-4139	KU	174.3	HIJ	13.0	DEF	23,724	HIJ	1,769.6	DEF
ORS 12154b	OG	173.1	HIJ	13.7	CDEF	23,563	HIJ	1,860.4	CDEF
Chubbiness	KU	154.2	IJ	13.0	DEF	20,995	IJ	1,769.6	DEF
3-F4221	KU	134.0	J	10.3	EF	18,243	J	1,406.6	EF
3F-2186	KU	130.2	J	9.3	F	17,717	J	1,270.5	F

[z]Plot size: 320 ft^2 .

[y]Means within columns separated by Fisher's least significant test ($P \leq 0.05$), means with same letter are not significantly different.

Table 2. Seedless watermelon varieties by average fruit weight by percentage and total bins, 2015.

Variety	Total Bins per acre		60-count 9-13.5 lbs		45-count 13.6-17.5 lbs	36-count 17.6-21.4 lbs		30-count >21.4 lbs	
Talca	86.7	A[z]	14	M	38	24	ABCDEF	24	AB
Maxima	74.1	AB	17	LM	26	30	AB	28	A
Exclamation	65.0	BC	19	JKLM	41	22	ABCDEFGH	16	BCD
Crunchy Red	61.5	BCD	28	FGHIJKLM	40	29	ABC	3	EFG
Summer Breeze	60.3	BCD	38	FGHIJKLM	36	22	ABCDEFGH	5	EFG
Excursion	59.7	BCDE	24	HIJKLM	28	23	ABCDEFG	23	ABC
Wolverine	59.7	BCDE	18	LM	47	30	AB	5	DEFG
Razorback	59.5	BCDE	32	FGHIJKLM	37	27	ABCDE	2	EFG
Neptune	59.2	BCDE	46	CDEFGH	38	13	DEFGHIJ	3	EFG
Joy Ride	58.0	BCDEG	24	HIJKLM	45	28	ABCD	3	EFG
Unbridled	55.0	BCDEGH	31	FGHIJKLM	47	16	BCDEFGHI	5	DEFG
Kingman	51.9	CDEGHI	38	FGHIJKLM	41	13	DEFGHIJ	7	DEFG
UGR 1762-14	51.9	CDEGHI	35	FGHIJKLM	36	22	ABCDEFGH	8	DEFG
Charismatic	51.2	CDEGHI	18	KLM	39	29	AB	13	CDE
KB12106	50.9	CDEGHI	44	DEFGHIJK	37	8	HIJ	12	DEF
Sweet Dawn	49.7	CDEGHI	25	GHIJKLM	31	34	A	9	DEFG
KB15010	49.4	CDEGHI	46	CDEFGHI	40	14	CDEFGHIJ	0	G
ORS 6227	48.2	CDEGHI	20	IJKLM	41	32	A	7	DEFG
Fascination	47.9	CDEGHI	36	FGHIJKLM	43	12	EFGHIJ	9	DEFG
Road Trip	47.9	CDEGHI	46	CDEFGHI	37	13	DEFGHIJ	4	EFG
Secretariat	46.4	CDEGHIJ	48	CDEFGH	42	8	HIJ	2	FG
Traveler	46.1	CDEGHIJK	48	CDEFGH	35	14	CDEFGHIJ	3	EFG
Captivation	45.1	CDEGHIJK	42	EFGHIJKL	49	9	FGHIJ	0	G
UGR 1763-14	44.4	DEGHIJK	25	GHIJKLM	56	14	CDEFGHIJ	5	EFG
Sugar Fresh	39.6	EGHIJK	51	BCDEFG	36	13	DEFGHIJ	0	G
UGR 1317-12	39.3	GHIJK	42	EFGHIJKL	53	4	IJ	2	FG
Wayfarer	38.8	GHIJK	53	ABCDEF	37	8	HIJ	2	EFG
ORS 6064B	38.1	GHIJK	53	ABCDEF	42	5	IJ	0	G
Poseidon	37.8	GHIJK	65	ABCDE	30	2	IJ	3	EFG
Prime	35.0	HIJK	44	DEFGHIJ	45	11	FGHIJ	0	G
3F-4139	34.5	IJK	68	ABCD	20	9	GHIJ	3	EFG
ORS 12154b	34.5	IJK	70	ABC	27	3	IJ	0	G
Chubbiness	31.8	IJK	75	AB	25	0	J	0	G
3-F4221	26.5	JK	77	A	20	2	IJ	2	FG
3F-2186	26.0	K	50	BCDEFG	45	4	IJ	0	G

[z] Means within columns separated by Fisher's least significant difference test ($P \leq 0.05$), means with same letter are not significantly different. Means without letters were not statistically different.

Table 3. Fruit quality of seedless watermelon varieties, 2016. Four fruit from every replication for each variety.

Variety	% soluble solids		Number of Black Seeds		Firmness (lbs-force)		Hollow Heart[z]
Road Trip	11.9	A[x]	0.3	B	3.3	CDEFGH	1.0
3-F4221	11.7	AB	0.3	B	2.6	IJKL	1.0
Joy Ride	11.6	ABC	0.3	B	3.3	CDEFGHI	1.0
Summer Breeze	11.6	ABC	0.3	B	3.1	DEFGHIJK	1.0
UGR 1762-14	11.6	ABC	0.1	B	2.4	KL	2.0
Unbridled	11.5	ABCD	0.3	B	3.2	DEFGHIJ	1.1
3F-2186	11.5	ABCD	0.3	B	2.4	KL	1.0
Charismatic	11.4	ABCD	2.8	AB	3.7	BCDE	1.2
Prime	11.3	ABCDE	0.0	B	2.1	L	1.1
Wayfarer	11.2	ABCDEF	14.5	A	3.1	DEFGHIJ	1.0
Poseidon	11.1	BCDEFG	0.8	B	2.5	JKL	1.3
UGR 1317-12	11.1	BCDEFG	11.8	AB	3.0	FGHIJK	1.2
UGR 1763-14	11.1	BCDEFG	0.2	B	2.9	GHIJK	1.5
Wolverine	11.1	BCDEFG	0.5	B	3.3	CDEFGH	1.0
3F-4139	11.0	BCDEFGH	3.3	AB	3.3	CDEFGH	1.2
Kingman	11.0	BCDEFGH	3.2	AB	3.5	CDEFG	1.0
Secretariat	11.0	BCDEFGH	2.8	AB	3.7	BCDE	1.1
Razorback	11.0	BCDEFGH	0.7	B	3.4	CDEFGH	1.0
Neptune	11.0	CDEFGH	4.3	AB	3.2	CDEFGHIJ	1.0
Chubbiness	10.9	CDEFGH	0.1	B	2.5	JKL	1.0
Sugar Fresh	10.9	CDEFGH	0.2	B	4.3	AB	1.0
KB15010	10.9	CDEFGH	4.8	AB	2.7	HIJKL	1.4
Maxima	10.8	DEFGH	0.3	B	2.7	HIJKL	1.2
ORS 6227	10.8	DEFGH	1.0	B	3.2	DEFGHIJ	1.2
Fascination	10.6	EFGHI	5.5	AB	3.3	CDEFGH	1.0
Sweet Dawn	10.6	EFGHI	5.7	AB	3.1	DEFGHIJK	1.0
Captivation	10.6	FGHI	0.4	B	3.9	ABC	1.0
Exclamation	10.5	FGHI	1.3	B	3.0	EFGHIJK	1.0
KB12106	10.5	FGHI	0.4	B	3.8	BCD	1.1
Crunchy Red	10.4	GHIJ	1.6	B	3.2	CDEFGHIJ	1.1
Excursion	10.4	HIJ	0.7	B	3.7	BCDEF	1.0
Talca	10.3	HIJ	1.8	AB	3.3	CDEFGHI	1.0
Traveler	10.0	IJ	0.3	B	3.2	CDEFGHIJ	1.0
ORS 6064B	9.9	IJ	0.3	B	4.5	A	1.0
ORS 12154b	9.8	J	1.0	B	2.7	HIJKL	1.2

[z]Hollow Heart: 1-none, 2-slight carpel separation, 3-One large gap evident, 4-2 large gaps, 5-severe carpel separation, 3 or more large gaps; fruit cut crosswise

[x]Means within columns separated by Fisher's least significant difference test ($P \leq 0.05$), means with same letter are not significantly different.

Winter Melon (*Benincasa hispida*) as a New Crop for Southwest Michigan

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Objective:

To evaluate the commercial potential of winter melon (Chinese wax gourd) under southwest Michigan growing conditions.

Summary:

All eight entries produced fruit, however, Long Giant's maturity period makes it unsuitable for production in Southwest Michigan. Large Round was the entry with the most commercial potential based on fruit size and yield. Southern Dark skin has potential if a larger melon is desired. The melons were generally well received by customers when sold through farmer's markets or directly to restaurants. The biggest concern of buyers was a size of 15 pounds or greater. Many non-Asian buyers will have to be educated on how to use the melons.

Materials and Methods:

Fertilizer: Prior to planting 33-0-0, 0-0-60, 95% sulfur and Solubor were broadcast and incorporated at 100, 175, 28 and 13 pounds/acre, respectively. After planting, 42 additional pounds of nitrogen was applied through the drip system as 28% nitrogen beginning 13 June and ending 1 August.
Planting: All entries were planted in the greenhouse 2 April, 2016 into 32 cell trays. Planting to the field was done 26 May, 2016 on plastic mulched, 6" high raised beds into which a drip tape was inserted at the time of bed shaping. Rows were spaced 5.5' on center with an in row spacing of 6' providing 1320 plants/acre. The trial was planted for observation only and was not subjected to statistical analysis. All seed was obtained from Evergreen Y. H. Enterprises, P.O. Box 17538, Anaheim, California.
Plant Care: Plots were irrigated as needed and disease and insect pests controlled using commercially recommended cultural practices. Weeds were controlled using the black plastic and suppressed between rows with Gramoxone.
Harvest and data collection: Harvest was conducted when fruit was considered to be mature. It was then counted and weighed. Data was not subjected to statistical analysis.

Results and Discussion:

Winter melon, or Chinese wax gourd, is used extensively in Southeast Asian cuisine. It is used in soups and stir fries of various kinds from India through China. It can also be stored at room temperature for several months, hence the name "winter melon". Although in a different genus, its growing requirements are similar to watermelon, a crop commonly grown in Southwest Michigan. For this reason, eight varieties were planted at

the Southwest Michigan Research and Extension Center in 2016 (Table 1.) to determine their commercial potential. The eight varieties had a range of size, shape and maturity (Table 1 and Figures 1 and 2).

Table 1. Number of fruit, and average fruit weight of eight winter melon varieties grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016.

Variety	Fruit Number	Avg. Fruit Weight (lbs.)	No. of Plants	Fruit per Plant
Hybrid Small Round	195	4.6	15	13
Large Round	29	23.0	5	5.8
Long Giant	3	62.1	6	0.5
Southern Dark Skin	23	31.3	11	2.1
Large Oblong	104	4.5	9	11.6
Hybrid Wonder Wax	29	15.1	16	1.8
Hybrid Thao Nuan	157	9.62	?	?
Hybrid Thai Small	115	8.0	17	6.8

Having little experience in producing winter melons, it is difficult to determine maturity. As fruit matures it generally develops a white wax coating that easily rubs off onto hands and clothes. The fruit also have stiff hairs that irritate the skin so it is best to handle them with gloves. Southern Dark Skin does not produce the wax but does have the hairs. Large Oblong matured first, not only developing the waxy coating earlier but the plants also died, exposing fruit to the sun (Figure 3). They were harvested in early September. Other selections were harvested mid-September through October. Harvest could possibly have been done earlier but was delayed due to lack of experience with the fruit.

Figure 1. Six winter melons grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan in 2016. Left to right: Hybrid Small Round, Large Round, Large Oblong, Hybrid Wonder Wax, Hybrid Thao Nuan and Hybrid Thai Small.

Figure 2. Long Giant (left) and Southern Dark Skin (right) winter melons grown at the Southwest Michigan Research and Extension Center, Benton Harbor, Michigan, 2016.

Figure 3. Long Oblong winter melon showing the white, waxy coating and senescing leaves indicative of harvest.

Hybrid Wonder Wax had extremely showy flowers (Figure 4) that where readily visible above the leaf canopy. The other entries had their flowers down under the leaf canopy. The exposed flowers may aid in attracting pollinators and increasing fruit set but other entries did not seem to suffer decreased fruit set. Long Giant had a low fruit set but is

Figure 4. Hybrid Wonder Wax with its showy flowers above the leaf canopy.

not well adapted to Southwest Michigan anyway since it requires 150 or more days to maturity.

An effort was made at marketing the winter melons through farmer's markets and Chinese restaurants. Our experience found shape was not a concern but size was. Most buyers wanted large fruit – 15 pounds or higher but they would take smaller melons down to 10 pounds. Melons were sold either by the melon or by the pound. Most melons of adequate size sold for either $4 or $5 a melon or $0.30 a pound.

Of the eight varieties evaluated, Large Round was the best performer in terms of number of fruit and fruit size. Other entries produced more fruit but it was smaller which was not as desirable for buyers. Hybrid Small Round not only had small fruit but also had fairly thin flesh. Of the two large fruit, Southern Dark Skin has more potential than Long Giant due to higher fruit set and shorter maturity time.